Distribution of Atlantic Cod (*Gadus morhua*) Eggs and Larvae on the Scotian Shelf

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ABSTRACT

Hanke, A.R., F. H. Page, and J. Neilson. 2000. Distribution of Atlantic cod (*Gadus morhua*) eggs and larvae on the Scotian Shelf. Can. Tech. Rep. Fish. Aquat. Sci. 2308: iii + 140 p.

The temporal and spatial distribution of sampling and the sampling protocols used during the Canadian Department of Fisheries and Oceans Larval Herring (LHP), Scotian Shelf Ichthyoplankton (SSIP) and Fisheries Ecology Programs (FEP) are summarized. In addition, the spatial distributions of Stage I, II and early Stage III cod/haddock/witch eggs and late Stage III cod eggs, Stage IV cod eggs and 1-7mm and >7mm cod larvae are presented for each survey and are aggregated over all programs and time to form bimonthly composites. To avoid standardizing the sampling effort for differences among sampling protocols and gear types used in the survey programs, the distributions of cod early life history stages were determined using a presence/absence criterion rather than the actual abundance. The samples selected from the LHP database were those collected using a 61cm Bongo outfitted with either 505 or 333-µm mesh and towed in a saw tooth fashion. The FEP is represented by samples taken with a 333-µm mesh and a double oblique tow only, whereas the SSIP is also represented by samples collected with a 471-µm mesh and an old stepped oblique tow.

RÉSUMÉ

Hanke, A.R., F. H. Page, and J. Neilson. 2000. Distribution of Atlantic cod (*Gadus morhua*) eggs and larvae on the Scotian Shelf. Can. Tech. Rep. Fish. Aquat. Sci. 2308: iii + 140 p.

Le présent document résume la distribution temporelle et spatiale des échantillons et des protocoles d'échantillonnage utilisés dans le cadre de trois programmes du ministères canadien des Pêches et des Océans, soit le Programme d'étude des larves de hareng (PELH), le Programme d'étude de l'ichtyoplancton de la plate-forme néo-écossaise (PEIPFNE) et le Programme de l'écologie des pêches (PEP). En outre, on présente des données sur la distribution spatiale des œufs de morue, d'aiglefin et de plie grise aux stades I et II et au début du stade III, ainsi que sur la distribution spatiale des œufs de morue à la fin du stade III, des œufs de morue au stade IV et des larves de morue mesurant de 1 à 7 mm et de >7 mm. Ces données sont présentées pour chaque relevé puis sont regroupées pour l'ensemble des programmes et réparties sur toute la période pour former des moyennes composées bimestrielles. Afin d'éviter de normaliser l'effort d'échantillonnage pour ce qui est des différences entre les protocoles d'échantillonnage et les types d'engins utilisés dans les programmes de relevé, les distributions de la morue aux stades précoces ont été déterminées au moyen de critères de détection d'indicateurs de présence ou d'absence plutôt qu'en fonction des effectifs réels. Les échantillons prélevés dans le cadre du Programme d'étude des larves de hareng ont été prélevés au moyen d'un filet Bongo de 61 cm, ayant un maillage de 505 ou de 333 µm, et moyennant des traits en forme de dents de scie. Le PEP est représenté par des échantillons prélevés au moyen d'un filet au maillage de 333 µm et de traits doubles obliques uniquement, alors que le PEIPFNE est également représenté par des échantillons prélevés au moyen d'un filet de maillage de 471 µm et d'un ancien modèle de traits obliques par paliers.

INTRODUCTION

The purpose of this report is to make the temporal and spatial distribution of cod eggs and larvae, contained within three Canadian Ichthyoplankton Survey Programs, readily available for quick visual perusal. Hence, the report briefly describes each survey program and the location of the data. It combines the information from all surveys into bimonthly and single composites for each early life stage to highlight the major temporal and spatial patterns in distribution and presents stage specific distribution plots for each individual survey within each program for more detailed reference. Investigators wishing to pursue more detailed analyses should extract the data from relevant databases.

Ichthyoplankton data have been used for a variety of fisheries-related studies. For example, Gagné and O'Boyle (1984) and O'Boyle et al. (1984) used Scotian Shelf Ichthyoplankton Program (SSIP) data to test hypotheses of larval retention, noting that for many species of fish occurring on the Scotian Shelf, both the eggs and larvae appear to be retained over the banks for considerable periods. Neilson and Hurley (1986), Neilson et al . (1986), Neilson et al. (1988) and Hunt and Neilson (1993) employed the data to elucidate stock structure of flatfish and gadids in Maritime waters. Hurley and Campana (1989) examined the Fisheries Ecology Program (FEP) data to describe the distribution of early life history stages of cod and haddock (*Melanogrammus aeglefinus*). However, no one work has composited all available ichthyoplankton data for cod (*Gadus morhua)* in the Maritimes Region in a comprehensive manner.

MATERIALS AND METHODS

DATA SOURCES

The data pertaining to the distribution of the early life stages of cod on the Scotian Shelf, eastern Gulf of Maine and the Bay of Fundy has been compiled from three Canadian Department of Fisheries and Oceans Icthyoplankton survey programs conducted during the 1970's, 1980's and 1990's. These programs were the Larval Herring Program (LHP), the Scotian Shelf Ichthyoplankton Program (SSIP) and the Fisheries Ecology Program (FEP). An overview of the temporal and spatial coverage of each of these survey programs is given in Table 1. A more detailed description of each program is given below.

Larval Herring Program

The Larval Herring Program (LHP) is an ichthyoplankton survey that has been conducted using standardized procedures since 1972 (Iles et. al., 1985). This report includes only surveys conducted until 1995. Survey coverage focused on the Bay of Fundy, the area off southwest Nova Scotia, and Georges Bank (Fig. 1). In the Bay of Fundy (BoF), spring and fall surveys were conducted each year from 1975 to 1984. Starting in 1985, the program was reduced to only one fall cruise per year (Table 2). The Georges Bank (GB) cruises began in 1987 and ended in 1995 and consisted of a single fall survey each year (Table 3). Seasonal coverage for the BoF and GB cruises is depicted in Fig. 2 and 3. Data from the surveys are stored in an ORACLE database residing at the St. Andrews Biological Station, New Brunswick, Canada.

The original purpose of the LHP was to increase knowledge of the ecology of herring larvae, and was designed to coincide with the larval abundance peak resulting from an assumed spawning peak of September 1 (Iles et al., 1985). Since 1981, the larval abundance index (LAI), based on 79 standard LHP stations, has been used in analyses for the 4WX herring stock assessment. Since the focus of the LHP was on herring, not all samples were sorted for species other than herring. Hence, there are some BoF and GB cruises not involved in the distribution plots. These exceptions are noted in Table 4.

The sampling scheme for the Bay of Fundy (BoF) surveys initially followed a standard grid of 116 stations (numbered 001-116). Stations on the grid were meant to be 10 nautical miles apart, but for practical reasons some are only 5 mi apart. Sampling was carried out within ±0.5 mi from the master station coordinates.

Over the years, the grid was expanded to 163 stations, with a number of additional random stations added periodically. In 1988, 1989, and 1990, 80 random stations were added to compare

with results obtained from regular grid stations. The 80 random stations were added in an area of traditionally high herring larval density off southwest Nova Scotia (Stephenson et. al., 1990).

The Georges Bank (GB) surveys within the Larval Herring Program followed a different sampling scheme. In this program, sample stations were allocated within a grid of 20 x 20 mi blocks. Beginning in 1988 this allocation was done on a random basis.

The spatial coverage of each survey is indicated by the distribution of sets in Fig. 8.1.1-8.2.7.

Scotian Shelf Ichthyoplankton Program

The Scotian Shelf Ichthyoplankton Program (SSIP) was conducted during the years 1976 - 1982. This program was designed "to provide basic information on the spatial and temporal distribution of eggs and larvae on the Scotian Shelf as an aid to the better management of the fishery." (O'Boyle et al. 1984). The data are maintained within an ORACLE database at the Bedford Institute of Oceanography. Detailed descriptions of the program and the data set are given in Anon. (1989). A brief summary of the program is given below with an emphasis on the surveys and sampling procedures used to collect the data analysed in this report.

The SSIP data set includes 39 surveys. Each survey covered the Scotian Shelf to some degree (Fig. 1). Five of the surveys were not included in the present analyses (Table 5) since the data associated with these were not appropriate for the present purpose. Three of these surveys were primarily patch studies focused on the limited geographic region of Emerald and Western Banks and two surveys targeted silver hake. The data for the remaining thirty-four surveys (Table 6) were available and were included in the present analyses. The temporal coverage by these cruises is presented in Fig. 4. The spatial coverage of each survey is indicated by the distribution of sets in Fig. 8.4.1-8.4.7.

Surveys conducted prior to 1977 consisted of a grid of 150 consecutive stations covering the Scotian Shelf from the Laurentian to the Northeast Channel. Beginning in 1977, a conventional sampling grid approach (the "Standard Transect Grid") covering the Scotian Shelf, parts of the continental slope and Georges Bank, and the northeastern half of the Gulf of Maine was adopted. The objective was to mirror the California Cooperative Oceanic Fisheries Investigations (CalCOFI) survey design, and in particular to achieve standardization with the Marine Resources, Monitoring, Assessment and Prediction (MARMAP) survey on the US East Coast. The grid consisted of 40 transect lines running perpendicular to the Nova Scotian coast, 15 miles apart. Stations along each transect were located at depth discontinuities. There were between 3 and 11 stations along each transect. In 1978 standardized procedures were adopted and a total of 245 stations were sampled. From 1979 - 1982, the sampling protocol was reduced to 150 primary stations in order to save time and help ensure the entire survey domain was sampled each survey.

Fisheries Ecology Program

The Fisheries Ecology Program (FEP) was initiated by the Marine Fish Division of the Canadian Department of Fisheries and Oceans to learn more about the ecology of the commercially important gadoid species, particularly haddock, on the southwestern Scotian Shelf (Smith et. al. 1989). The surveys covered the Scotian Shelf off southwest Nova Scotia (Fig. 1). Yearly, five surveys were conducted from 1983-1985 (Table 7), for a total of 15. In each year, the surveys were conducted monthly from February through June (Fig. 5).

The initial 1983 sampling scheme for the survey consisted of a grid composed of 11 transects and 85 stations in total. The stations were approximately 28 km apart for most of the survey domain and somewhat closer over the western portion of Brown's Bank. In 1984 and 1985, two additional transects were added that traversed Brown's Bank. There were 6 stations in each new transect for a total of 97 stations (Hurley and Campana, 1989). Like the data from the SSIP, the data are stored in an ORACLE database maintained at the Bedford Institute of Oceanography. The spatial coverage of each survey is shown in the plots of Fig. 8.3.1-8.3.7.

Sample storage identification and protocols

Many thousands of plankton samples were collected during the LHP, SSIP and FEP (Tables 8, 9, 10, 11). The range of sampling approaches included vertical hauls with a 1m net, oblique and saw tooth tows with a 61-cm Bongo or Isaacs-Kid net to within 5 m off the bottom or 200 m maximum depth and surface tows with a 61-cm Bongo or Neuston net. Of these approaches, only the Bongo tows were processed for ichthyoplankton and only the information from the saw tooth and oblique Bongo tows was used in the present analyses. Depth was determined by a conductivity-temperature-depth (CTD) recorder attached above the Bongo frame. A flow meter attached inside the mouth of the net measured the volume of water filtered through the nets during each tow. The nets were towed at a target speed of 2.5 knots (1.3 $m \cdot s^{-1}$), lowered and retrieved at wire out and in rates of 20 and 50$m \cdot min^{-1}$, respectively. A range of mesh sizes was also used with each gear type (Table 8,9,10,11). More than 90% of the port samples and less than 50% of the starboard samples were processed for fish eggs and larvae. During the FEP in 1984 and 1985, replicate Bongo samples were taken immediately after completion of the first tow by returning to the initial starting location and redeploying the Bongo gear. These replicate tows accounted for 67% of the stations sampled during the FEP. The starboard samples were generally sorted to compare the catches from port and starboard nets and when the port sample was unavailable. Rather than use the information from both replicate tows and both sides of the Bongo, when these were available, only the information from the port side of one sample was used in the present analyses. However, in cases where a port sample was not available, a starboard sample, if available, was used instead.

The fish eggs and larvae from each sample were classified into four developmental stages (Table 12) and identified to species when possible. The larvae were measured to the nearest millimeter. Samples containing more than 200 eggs were sub-sampled using the beaker split method of Van Guelpen et al. (1982). Since the Stage I, Stage II and early Stage III eggs of cod, haddock and witch cannot be distinguished from each other, they were identified as cod/haddock/witch (CHW) eggs or less frequently as cod/haddock (CH) eggs.

DATA ANALYSES

Type of data extracted

From the above cruises, certain data records were not selected because they were associated with undesirable fish and egg identification protocols (fishproc codes 2, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16; Table 13). This restriction eliminated entire cruises from the LHP program as indicated in previous sections (Tables 4 and 5). Acceptable fishproc codes included 1, 3, 4, 6 and 7. Where fishproc was 6 (identified and counted selected fish and no fish eggs) the selected species was cod in only three samples (cruises P180 and P193). Note that although the database indicated that three cod larvae were caught, no lengths were given for these larvae. Distribution plots were nevertheless generated for the two cruises. When fishproc was 3 (identified and counted all fish and no fish eggs) only larval plots were generated (e.g. cruises P190 and P217). When fishproc was 4 (identified and counted selected fish and all fish eggs) or 7 (identified and counted no fish and all fish eggs) only egg stage plots were created (e.g. cruises P160, P175, P190 and P207). Fishproc 1 yielded both larval and egg stage plots.

Of the remaining records, those samples originating from a 61 cm bongo (geartype=94), towed according to the saw tooth (gearproc=7), old stepped oblique (gearproc=4) or MARMAP double oblique (gearproc=3) procedures, were retained. This selection resulted in all the acceptable LHP cruises being saw tooth bongos and all SSIP/FEP cruises being MARMAP double oblique bongos except cruises P170, P182, CL01, FT01, CC01 and CC02 which were old stepped oblique bongo tows.

Valid net mesh sizes for the bongo tows were limited to 333, 471 and 505 µm, where preference was given to the smallest mesh available and the port side sample. If these criteria were associated with more than one sample/set, the record with the smallest sample number was selected. The 471-µm mesh was used exclusively for bongo tows in cruises P182, CL01, CC01 and CC02.

Records were also rejected according to their method of sample preservation. When sampcura, the database field for sample processing,

was null, 1 or 99, the record was discarded because the sample was considered damaged, lost or unrepresentative.

Finally, each record was associated with a station identifier, set number, date and geographic position. The position of a station was reduced to the minimum latitude and longitude for the minimum set number, since several tows may be associated with each set and multiple sets with each station. In the case of Bay of Fundy cruises, random stations were omitted (those stations beginning with R or A) because they were added in only three years in areas of traditionally high herring density off the coast of southwest Nova Scotia. Their purpose was for a comparison with results from regular grid stations. These extra stations represent, at most, 11 cod larvae and 23 cod eggs occurrences.

Presence/absence plots

A presence/absence approach was considered the best way for visualizing the general patterns in cod distributions. Distributions represented by abundance at location are unduly influenced by those locations where large numbers are caught. Even log-scale transformations cannot reduce the visual impact that these high catches have on the perception of cod distribution. The equal weighting that a binary approach attributes to each location where cod were found may be a more appropriate way of dealing with inadequacies in the sampling grid.

Temporally, a binary representation is also more robust. Complex physical processes control the distribution of ichthyoplankton on a continuing basis. Yet, abundance-based distributions present the data as though it came from a static environment without a significant temporal component incorporated in the sampling. The binary approach devalues the significance timing has on the perceived distribution of cod eggs and larvae since only areal issues are important.

For those situations where samples have various collection histories, abundance based distribution plots should not be produced without first transforming the samples to a common collection protocol (sampling effort). Standardization may not always be possible since the conversion relationships are not always known. A presence/absence approach minimizes the standardization issue because knowledge of relative abundance is not required.

Distribution plots of the presence and absence of each early life stage were plotted for each individual survey. To help extract robust features in the temporal and spatial distribution of the early life stages the data were also composited into a single distribution plot and bimonthly plots for each stage. All plots depict the location of the target species given the data selection criteria described above. For the composite plots, the presence of the target species was shown when more than one egg or larva was counted in a sample. This elevated detection threshold was established to decrease the likelihood of plotting misclassified eggs or larvae or outliers in both space and time. The overall outcome was a more compact plot of species distribution that showed more coherence from month to month and among stages. A shortcoming of the plots is their ability to mislead the eye when comparing regions with unequal sample densities. This problem is particularly evident when comparing the eastern Scotian Shelf with either Georges Bank or the Bay of Fundy at certain times of the year.

The early developmental stages (Stages I, II and early Stage III) of cod, haddock and witch cannot be classified to the species level. Hence, the presence data for the early stages of cod was obtained by apportioning the data identified as the species mix of cod/haddock/witch (CHW) and cod/haddock (CH) for each sample. The proportion of Stage I, II and early Stage III cod in the mix of CHW and CH was assumed to be identical to the proportion of late Stage III cod caught relative to the total number of late Stage III cod, haddock and witch caught in the sample. The Stage I and II apportioned data are presented in the general and bimonthly plots. However, for the Stage I, II and early Stage III cruise plots, all locations where CHW and CH were found were superimposed on the locations where late Stage III cod were found. This allows the reader to judge which CHW and CH locations contained cod based on their proximity to known cod locations.

RESULTS

Before the bimonthly plots are described (Fig. 7.1-7.6), a cautionary note regarding the sampling intensity in each season is warranted. Upon examination of the cruise dates for each program, one will note that the sampling intensity is not even throughout the year. The FEP only has data from February 1 to June 21 in three years, 1983-85. The GB arm of the LHP sampled October from 1987 to 1991 and November from 1992 to 1997. The BOF arm of the LHP, in addition to sampling in October/November from 1975 to 1997, sampled March from 1975 to 1984 and August from 1977 to 1980. The SSIP sampled in virtually every week of the year, but the majority of effort was centered on the period between August 1 and September 31 from 1975 to 1982 and in the remainder of the year some months may only be represented by 1 or 2 years. Thus, when the data from all programs is aggregated into bimonthly plots, the FEP and BOF are the main contributors to the March-April plot while the fall BOF cruises and GB cruises are the main contributors to the November-December plot. The July-August plot gets some data from the BOF cruises but more from the SSIP. The remaining plots have a large SSIP/FEP component. Also, some of these plots are supported by an unbroken time series while others represent a short segment of time. In fact, the points on the plot will also have a hidden degree of sampling where the same location is visited in multiple years but is represented by a single point. Consequently, comparisons between plots for different months should be done with the understanding that some plots have had a higher level of sampling which may give the impression of more eggs or larvae. Comparisons between stages for the same bimonthly period are more appropriate.

GENERAL COMPOSITE

The general composite plots identify the geographical extent of the early life stages of cod ichthyoplankton aggregated over all programs, seasons and years. The Stage I and II plots show possible cod spawning areas within the domain of the Stage III cod egg areas. Thus, one will never find Stage I and II cod eggs in locations where Stage III eggs were not found. The primary Stage I and II sites include Georges Bank, Browns Bank, inshore off the west and south coasts of Nova Scotia, Western Bank, Sable Island Bank and Banquereau Bank. The Stage III plot shows that, in addition to the aforementioned areas, eggs were found west of Grand Manan and on the eastern Scotian Shelf including Emerald Bank, Middle Bank, Misaine Bank, Canso Bank and St. Anns Bank. Eggs were rarely found in the basins and in water deeper than 100 m.

The distributions of the Stage IV eggs and larvae 1-7 mm long are similar to the Stage III eggs but more contracted. On the eastern flank of the Scotian Shelf few occurrences of larvae were observed. Larvae >7 mm in length had even smaller areal extents and were only observed on Georges Bank, Browns Bank and the Emerald/Western/Sable Island Bank area.

BIMONTHLY COMPOSITES

The distribution of cod looks similar in the bimonthly composite plots for Stages I and II. In January-February spawning of cod begins on Georges Bank. The areal coverage of cod spawning expands in the March-April period to include Browns Bank, Western and Sable Island Banks and southeast Nova Scotia. In the May-June period the focus shifts to the eastern section of the Scotian Shelf, while Browns Bank shows two occurrences.

The end of the spring spawning is marked by a virtual absence of cod in the July-August plot. By September-October some Stage I and II cod eggs are found off Lurcher Shoals, southwestern Nova Scotia off St. Mary's Bay, Georges Bank and in the Sable/Banquereau Bank area. The coastal spawning begun off Lurcher Shoals decreases in November-December and extends to the southern coast of Nova Scotia. The Western to Banquereau Bank areas, and especially Georges Bank, show enhanced activity.

The presence of Stage III cod eggs appears to be most prominent in two time periods; March-April and November-December. In March-April spawning is observed off southwestern Nova Scotia including Browns Bank, Georges Bank and in the Emerald/Western/Sable Island Bank area. The May-June period, while showing the end of spawning that peaked in March-April on Browns and Georges Bank, also shows new activity in the Banquereau/Misaine/St. Anns Bank area. In the fall, spawning again occurs on Georges Bank and also around the entire Nova Scotian coast, west of Grand Manan and on Western/Sable

Island/Banquereau Bank. All other time periods appear to show remnants of, or precursors to, the spawning that occurred in March-April and November-December.

The above patterns are also evident in the bimonthly composites of the distribution of Stage IV cod eggs and newly hatched 1- to 7-mm long larvae, albeit somewhat compressed (Fig. 7.4 and 7.5). The single exception is the spatial shift of cod in May-June on the eastern Scotian Shelf. As Stage III eggs they were found in the Banquereau/Misaine/St. Anns Bank area, while as Stage IV eggs the area expands west to include Sable Island and Middle Banks. The 1- to 7-mm long larvae continue the shift west departing Banquereau/Misaine/St. Anns Bank and occurring in the Emerald/Western/Sable Island/Middle/ Bank area. For those larvae greater than 7 mm, the trend west continues and there is also a shift from Browns to Georges Bank in the same May-June period

CRUISE SPECIFIC DISTRIBUTIONS

LHP-Bay of Fundy (Fig. 8.1.1-8.1.7)

For the plots combining the occurrence of an early egg stage with late Stage III cod eggs, there was only one complete cruise where early life stages were present and late Stage III eggs were not. This occurred for the August 1979 cruise and may be attributed to the presence of non-cod eggs. In other surveys, the occurrence of Stage I to early Stage III CHW and CH eggs was largely coincident with late Stage III cod egg locations. And where the occurrence of the Stage I to early Stage III eggs was great, their location both supported and expanded from the areas where late Stage III cod eggs were found. The extended areas included the coastal zones adjacent to Grand Manan and the northern, western and southern shores of Nova Scotia.

Despite both fall and spring cruises, no Stage III eggs were found from the spring of 1975 until the fall of 1981. No Stage IV eggs were recovered until the summer of 1979. In both cases, eggs were found in every year thereafter; however the size and location of the distributions fluctuate. The Stage IV distributions tended to be smaller areally compared to the Stage III plot for the same cruise. As with the Stage IV eggs, larvae were not caught until August 1979. Thereafter, they were caught in every year but in fewer locations compared to the eggs. Larvae greater than 7 mm were found in very few locations. There is no suggestion of a shift in distribution as the early life stages develop.

LHP-Georges Bank (Fig. 8.2.1-8.2.7)

Georges Bank was sampled from 1987 to 1995 and in every year that Georges Bank was sampled, Stage I to early Stage III eggs were found both in and around areas with late Stage III cod eggs. These early life stages were also observed on Browns Bank when sampling extended to this area. Whereas the occurrence of late Stage III cod eggs fluctuated, the Stage I to early Stage III CHW and CH eggs had a consistently high presence on the Bank over time.

The distribution of Stage III and IV cod eggs in the last four years of sampling was much broader than in the previous five years and was centered over the northern tip of the Bank. The absence of large areas of cod eggs between 1989 and 1991 is more evident for the Stage IV eggs. This distributional difference corresponds to a shift in the timing of the sampling from late October to late November and more extensive sample coverage. Larvae from 1-7 mm are almost entirely absent except from 1993-95 and those larger than 7mm were not seen at all. This suggests that the fall spawning on Georges Bank began in mid-November.

FEP (Fig. 8.3.1-8.3.7)

The FEP data set provides a good time series for cod distribution in a select number of years, months and geographic locations. The Stage I, II and early Stage III CHW and CH eggs were often found throughout the whole survey area. The 1984 sample year yielded the smallest number of these mixed species eggs, particularly Stages I and II. The late Stage III cod eggs were observed within the domain of the earlier stages.

The peak occurrence of Stage III cod eggs, in the first year, 1983, was between April 7 and April 20, where the period between February 9 and June 12 was sampled. The eggs were found from the tip of Georges Bank to the southern tip of Nova Scotia. These patterns hold for Stage IV eggs and even the 1- to 7-mm long larvae. Newly hatched

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cod larvae were most prevalent in May as were the older larvae (>7 mm).

In 1984, late Stage III cod eggs occur in every month over the period from February 8 to June 21, with the greatest occurrence from March 22 to May 23. Browns Bank appears to have the largest concentration of eggs but it is also the most heavily sampled region. The Stage IV eggs have a lower occurrence and are not as obviously centered on the vicinity of Browns Bank. The occurrence of 1- to 7-mm long larvae in March off Georges Bank is followed by a substantial patch over Browns Bank in June. No meaningful quantities of larvae >7 mm were found.

In the last year, 1985, the months of March, April and May again show high concentrations of late Stage III cod eggs on Browns Bank. Occurrences of Stage IV eggs and 1-7 mm larvae were similar. Larvae >7 mm were absent. In none of the years is there clear evidence of a distribution shift as the early life stages develop.

SSIP (Figures 8.4.1 to 8.4.7)

As with the FEP, the SSIP has good information on the intra-annual temporal variation of cod egg and larvae distribution but over a greater number of years, 1977-82. The spatial coverage was large, namely, the entire Scotian Shelf as opposed to the area covering Browns and Georges Bank. Consequently, the samples were further apart.

In the first year, 1977, samples were collected from mid-February to mid-October, with February showing the highest occurrence of Stages I, II and early Stage III CHW and CH eggs. The early Stage III eggs were distributed over much of the Scotian Shelf whereas Stages I and II were only on the Browns and Sable Island Banks. May had the highest occurrence of Stage III cod eggs and these were distributed over the entire Scotian Shelf. Stage IV cod eggs and larvae had a similar temporal/spatial pattern, however, the 1- to 7-mm and >7-mm larvae were only associated with the Sable Island and Western Banks.

In the following year, 1978, the early egg stages were prevalent in the May-July sampling period as were the late Stage III cod eggs. The mixed species eggs were found in the proximity of the late Stage III cod eggs with the early Stage III eggs showing the broadest coverage. As in the previous year, the Stage III and IV cod eggs could only be found in the May-July sampling period. These eggs spanned the St. Anns/Banquereau/ Misaine Bank area of the eastern Scotian Shelf. As with the eggs, both 1- to 7-mm and >7-mm larvae were only found in the May-July sampling period, around Browns and Georges Banks. In the remainder of the year there were few occurrences of eggs or larvae with the exception of a small number of early Stage III eggs in August.

The temporal coverage in 1979 was much broader than in the previous two years, extending from January 23 to December 5. While few Stage III eggs were detected, the January, April and May samples yielded survey-wide occurrences of early Stage III and Stage II eggs. Stage I eggs had a similar pattern but with fewer occurrences. Significant concentrations of Stage IV eggs were found in April in the Browns/Baccaro Bank and Western/Sable Island Bank areas. In addition, eggs were detected in November in the coastal Nova Scotia and Western/Sable Island Bank areas. Larvae 1-7 mm long followed the same temporal and spatial pattern as the Stage IV eggs with additional larvae being found in May in the Western/Sable Island Bank location. For the larvae >7 mm, individuals were found in May rather than April and showed a reduced presence in November. Occurrences of the larvae >7 mm were limited to the vicinity of the Western/Sable Island Banks.

In the 1980 sampling year, the first survey wide peak in occurrence of early egg stages occurred in May and June, as there was no sampling in the two months prior. A small occurrence of late Stage III cod eggs was detected on Middle/Misaine/Banquereau Banks in May. As in 1979, a large occurrence of late Stage III cod eggs was detected around Sable Island Bank (October-December) and coastal Nova Scotia (November-December). A significant occurrence of the earlier CHW and CH egg stages was also detected at this time. Stage IV eggs were distributed similarly in all months except May, which had many more locations with eggs, distributed over more of the western Scotian Shelf. Larvae 1-7 mm long had the same temporal/spatial patterns as the late Stage III and IV cod eggs, and additional amounts were detected in June around Emerald Bank. The larvae >7 mm continued to show more occurrences in June and were more

frequent on the middle Scotian Shelf, and less frequent further to the east. Very few large larvae were seen in November/December; however, January of 1981 had observations on Emerald/ Western /Sable Island Bank.

Unlike 1980, samples were taken in March-April of 1981 and these revealed the highest occurrence of Stage III and IV cod eggs and 1- to 7-mm larvae for the year. The earlier Stage I and II CHW and CH eggs were found inside the domain of the late Stage III cod eggs and there were few early Stage III CHW and CH eggs observed. No samples were taken after October 9, and consequently, no fall spawning was detected. Most occurrences were on Emerald/Western/ Sable Island Bank, while the 1-to 7-mm long larvae were generally restricted to the Emerald/Western Bank area. Larvae >7 mm were also detected in this same area.

The last year for sampling, 1982 had inconsistent spatial coverage. Also, the timing of the samples was such that the traditional spring and fall spawning times were completely missed. As a result, a few late Stage III cod eggs were found in January (Georges/Browns) and some Stage IV cod eggs in May in the Georges/Browns Bank region. For larvae 1-7 mm the most frequent occurrences were on Georges Bank and off southwest Nova Scotia. Virtually no larvae >7 mm were found. The earliest egg stages were in the same areas as the older ones with the exception of the July sample, which showed early but no late egg stages. This July occurrence may reflect the presence of non-cod eggs in the sample.

SUMMARY

Fluctuations in the occurrence of cod from year to year served to highlight the difficulties of sampling populations that not only have large territories but also remain reproductively active over significant periods of the year. Combined with a limited sampling budget and continual fishing pressure it is not difficult to imagine how portions of or entire populations could be missed in some years and not in others. Variation in spawning year class size and shifts in environmental optima, which may trigger spawning, may also account for those instances where no cod were found, distributions shrank and/or spawning areas moved. These complications were smoothed over through the aggregation of data from different ichthyoplankton monitoring programs that covered a variety of locations and time periods. This compositing filled in spatial and temporal holes and consequently helped to define the regional and temporal bounds of cod spawning stocks in the Bay of Fundy and Scotian Shelf. The composite data support the existence of fall and spring spawning populations with regional distinctions for each. Spatial differences in the distribution of early life stages were generally not seen. The only pronounced shift occurred on the eastern Scotian Shelf where the distribution moved from east to west with progressively older stages.

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Table 1. A brief overview of the temporal and spatial coverage of the ichthyoplankton surveys summarized in this report.

Program	Temporal Coverage	Spatial Range	Spatial Coverage	NAFO Area
LHP Bay of Fundy	1975-1984: 1 spring and 1 fall cruise (plus, 1977-1980: 1 summer cruise)/year 1985-1995: 1 fall cruise	Lat: 41°15'-45°58.38' N Long: 61°24.38'-68°07' W	Bay of Fundy Area off south-west Nova Scotia	Mostly 4X
LHP Georges Bank	1987-1995 1 fall cruise/year	Lat: 40°15'-45°46' N Long: 62°29.92'-68°59.43' W	Georges Bank	5Z 4X
FEP	1983-1985 Monthly, Feb.-Jun. (5 cruises/year)	Lat: 41°28.23'-45°10.62' N Long: 64°18.51'-67°21.09' W	Area off south-west Nova Scotia	4X only
SSIP	1976-1982 Spring, summer, fall, and winter cruises (4-7 cruises/year) 1976: 1 summer cruise only	Lat: 40°28.05'-47°10'00" N Long: 56°41.26'-65°30'30" W	Scotian Shelf, not including the Bay of Fundy	4V 4W 4X

Table 2. The survey dates for all ichthyoplankton cruises appearing in the distribution plots and conducted by the Larval Herring Program in the Bay of Fundy. The number of stations sometimes exceeds the number of standard stations because of additional special sampling needs.

Cruise	Year	Start Date (dd mm)	End Date (dd mm)	# Sets	# Stations	# Standard Stations	# Standard ICNAF Stations
P151	1975	02 Apr	11 Apr	130	130	113	17
P160	1975	05 Nov	13 Nov	100	91	87	4
P175	1976	10 Nov	17 Nov	124	116	110	6
P180	1977	22 Mar	30 Mar	97	96	89	7
P190	1977	18 Oct	25 Oct	128	128	115	13
P193	1978	15 Mar	01 Apr	113	113	113	0
P207	1978	01 Nov	07 Nov	115	115	115	0
P217	1979	23 Mar	29 Mar	114	113	113	0
P227	1979	08 Aug	16 Aug	162	143	?	?
P250	1981	03 Mar	12 Mar	152	152	144	8
P263	1981	10 Nov	22 Nov	151	151	143	8
P268	1982	05 Mar	18 Mar	150	150	142	8
P280	1982	27 Oct	08 Nov	195	160	143[a]	9
P287	1983	15 Mar	27 Mar	159	158	142	16
P298	1983	01 Nov	12 Nov	163	156	146	10
P301	1984	28 Feb	13 Mar	135	107	102	5
P315	1984	02 Nov	14 Nov	179	173	148[b]	9
P329	1985	22 Oct	13 Nov	243[c]	162	144	9
P344	1986	28 Oct	12 Nov	188	164	153	9
P361	1987	21 Oct	11 Nov	255	163	152	9
P377	1988	25 Oct	09 Nov	206	206	145	8
P391	1989	25 Oct	08 Nov	226	225	159	9
P408	1990	25 Oct	06 Nov	158	154	131	4
P422	1991	02 Nov	14 Nov	142	134	130	3
P437	1992	29 Oct	11 Nov	144	125	119	6
P451	1993	24 Oct	04 Nov	124	124	118	6
N211	1994	02 Nov	15 Nov	166	162		7
N232	1995	01 Nov	13 Nov	125	100		2

[a] 8 Non-standard stations are AM02, AM08, AM10, I046, I047, I048, I052, I056.
[b] 10 Non-standard stations are A001-A009, I089
[c] Usual survey extended for intensive sampling of southwest Nova Scotia area (4 passes) during this cruise. Many stations sampled >= 2 times (Stephenson and Power 1989).

Table 3. The survey dates for all ichthyoplankton cruises appearing in the distribution plots and conducted by the Larval Herring Program on Georges Bank. The number of stations sometimes exceeds the number of standard stations because of additional special sampling needs.

Cruise	Year	Start Date (dd mm)	End Date (dd mm)	# Sets	# Stations	# Standard Stations
H181	1987	26 Oct	09 Nov	106	46	37
H195	1988	29 Oct	09 Nov	87	80	57
H207	1989	26 Oct	08 Nov	129	101	93
H222	1990	28 Oct	06 Nov	112	102	80
H235	1991	02 Nov	10 Nov	97	93	74
Z049	1992	24 Nov	30 Nov	86	86	86
N195	1993	14 Nov	24 Nov	72	71	71
N213	1994	17 Nov	26 Nov	106	104	88
N233	1995	17 Nov	28 Nov	113	110	90

Table 4. The survey dates for ichthyoplankton cruises not appearing in the distribution plots and conducted by the Larval Herring Program. The number of stations sometimes exceeds the number of standard stations because of additional special sampling needs.

Cruise	Year	Start Date (dd mm)	End Date (dd mm)	# Sets	# Stations	Comments
P163	1976	24 Mar	31 Mar	131	131	Not known if sorted for cod.
P186	1977	09 Aug	16 Aug	132	132	Not known if sorted for cod.
P202	1978	15 Aug	20 Aug	115	115	Not known if sorted for cod.
P226	1979	25 Jul	26 Jul	19	19	Not known if sorted for cod.
P228	1979	20 Aug	26 Aug	116	116	Not known if sorted for cod.
P232	1979	31 Oct	06 Nov	115	115	Not known if sorted for cod.
P234	1980	04 Mar	13 Mar	111	111	Not known if sorted for cod.
P243	1980	12 Aug	20 Aug	160	160	Not known if sorted for cod.
P246	1980	03 Nov	12 Nov	131	131	Not known if sorted for cod.
V710	1997	13 May	25 May	38	38	A Bras d'Or Lakes survey.
V778	1997	20 Jun	26 Jun	53	53	A Bras d'Or Lakes survey.
N770	1997	19 Nov	21 Nov	107	97	Data was unavailable.

Table 5. Ichthyoplankton surveys that are considered part of the Scotian Shelf Ichthyoplankton Program (SSIP) data set but were not included in the present analyses. Information in this table obtained from Anon. (1989).

Cruise	Year	# Oblique Bongo Tows	Comments
AP01	1980	79	• a joint Canada-USSR survey • sampling part of a patch study restricted to Emerald Bank
AP02	1980	27	• a joint Canada-USSR survey • sampling part of a patch study restricted to Emerald Bank
HO41	1980	229	• a joint Canada-USSR survey • sampling primarily a patch study on Emerald and Western Banks
AR01	1980	80	• a silver hake survey
AR02	1980	38	• a silver hake survey

Table 6. The survey dates for ichthyoplankton cruises appearing in the distribution plots and conducted by the Scotian Shelf Ichthyoplankton Program. The number of stations sometimes exceeds the number of standard stations because of additional special sampling needs.

Cruise	Year	Start Date (dd mm)	End Date (dd mm)	# Sets	# Stations	# Standard Stations
P170	1976	12 Aug	24 Aug	76	76	
CC01	1977	15 Feb	26 Mar	176	136	
P182	1977	30 Apr	19 May	129	129	
CL01	1977	8 Aug	2 Sep	159	159	
FT01	1977	21 Sep	19 Oct	161	149	
CC02	1978	17 May	14 Jul	395	199	
VY01	1978	06 Aug	25 Aug	147	147	
H005	1978	09 Aug	16 Aug	53	53	53
H006	1978	20 Aug	01 Sep	95	95	95
VY02	1978	29 Aug	15 Sep	149	148	
H007	1978	06 Sep	08 Sep	20	20	20
H011	1979	23 Jan	02 Feb	37	37	37
H015	1979	02 Apr	25 Apr	124	124	124
H018	1979	14 May	31 May	78	78	78
VN01	1979	04 Aug	19 Aug	126	126	126
VN02	1979	24 Aug	10 Sep	125	125	125
H025	1979	24 Sep	12 Oct	91	91	91
H028	1979	13 Nov	05 Dec	118	118	118
H032	1980	05 Feb	28 Feb	95	95	95
H035	1980	07 May	29 May	138	138	138
H036	1980	03 Jun	26 Jun	153	153	153
BR02	1980	11 Jul	04 Aug	91	91	91
LE01	1980	15 Aug	31 Aug	130	130	
LE02	1980	4 Sep	22 Sep	126	125	
AR03	1980	02 Oct	29 Oct	122	122	122
H045	1980	20 Nov	14 Dec	100	100	100
H047	1981	22 Jan	19 Feb	156	156	153
H050	1981	24 Mar	14 Apr	109	109	109
EK01	1981	26 Aug	12 Sep	79	79	79
EK02	1981	16 Sep	09 Oct	99	99	99
H069	1982	07 Jan	28 Jan	46	46	46
P271	1982	07 May	20 May	35	35	35
P276	1982	13 Jul	05 Aug	97	97	97
EK04	1982	23 Sep	12 Oct	92	92	92

Table 7. The survey dates for ichthyoplankton cruises appearing in the distribution plots and conducted by the Fisheries Ecology Program. The number of stations sometimes exceeds the number of standard stations because of additional special sampling needs.

Cruise	Year	Start Date (dd mm)	End Date (dd mm)	# Sets	# Stations	# Standard Stations
H091	1983	09 Feb	17 Feb	53	53	53
H093	1983	06 Mar	16 Mar	50	50	50
P288	1983	07 Apr	20 Apr	49	49	49
H097	1983	04 May	13 May	78	78	78
H099	1983	04 Jun	12 Jun	82	81	81
H112	1984	08 Feb	22 Feb	74	73	73
H114	1984	22 Mar	29 Mar	54	54	54
H116	1984	17 Apr	25 Apr	62	62	62
H118	1984	15 May	23 May	70	70	70
H120	1984	12 Jun	21 Jun	84	82	82
H130	1985	05 Feb	21 Feb	89	84	81
H132	1985	14 Mar	27 Mar	66	48	48
H133	1985	03 Apr	17 Apr	109	88	80
H135	1985	07 May	16 May	73	57	57
H137	1985	04 Jun	13 Jun	79	61	61

Table 8. Gear type and the number of samples collected and processed as part of the Larval Herring Program (BoF). For Gear/Tow Type, the numbers indicate the mesh size used, S indicates a starboard sample, P indicates the port sample.

Gear/Tow Type	Total tows	Number of tows processed for fish and/or fish eggs	Proportion of total tows processed (%)
0.5m NET - Vertical			
64µm	466	0	0
253µm	529	120	22.68
BONGO (61cm) - ICNAF Double Oblique			
P505µm	1	0	0
S505µm	1	0	0
BONGO (61cm) - Surface			
P505µm	77	0	0
S505µm	77	0	0
BONGO (61cm) – Saw Tooth			
P333µm	91	83	91.21
P505µm	6061	4631	76.41
S333µm	1547	353	22.82
S505µm	4468	928	20.77
NEUSTON – Surface			
1179µm	468	3	0.64
ISAACS-KID – Saw Tooth			
S505µm	1	0	0
Total	13787	6118	44.38

Table 9. Gear type and the number of samples collected and processed as part of the Larval Herring Program (GB). For Gear/Tow Type, the numbers indicate the mesh size used, S indicates a starboard sample, P indicates the port sample. A fish processing code of 0 was considered to mean not processed.

Gear/Tow Type	Total tows	Number of tows processed for fish and/or fish eggs	Proportion of total tows processed (%)
UNKNOWN (code 77) - Vertical			
53µm	145	115	79.31
BIONESS – Old Stepped Oblique			
333µm	169	131	77.51
BIONESS – Saw Tooth			
333µm	88	67	76.14
BONGO (20cm) – Saw Tooth			
P064µm	63	0	0
P333µm	2	0	0
S064µm	63	0	0
S333µm	2	0	0
BONGO (61cm) – ICNAF Double Oblique			
P505µm	25	22	88.0
S505µm	25	3	12.0
BONGO (61cm) – Saw Tooth			
P064µm	1	0	0
P333µm	726	215	29.61
P505µm	524	387	73.85
S064µm	1	0	0
S333µm	1134	270	23.81
S505µm	93	1	1.07
BONGO (61cm) – Saw Tooth Vertical Profile			
P333µm	6	0	0
S333µm	6	0	0
Total	3073	1211	39.41

Table 10. Gear type and the number of samples collected and processed as part of the Fisheries Ecology Program. For Gear/Tow Type, the numbers indicate the mesh size used, S indicates a starboard sample, P indicates the port sample and MARMAP stands for Marine Resources, Monitoring, Assessment and Prediction.

Gear/Tow Type	Total tows	Number of tows processed for Fish and/or Fish Eggs	Proportion of Total Tows Processed (%)
1m NET – Vertical			
64µm	199	0	0
80µm	48	0	0
120µm	138	0	0
202µm	3	0	0
253µm	5	0	0
BONGO (61cm) - MARMAP Double Oblique			
S080µm	20	0	0
P165µm	189	0	0
S165µm	57	0	0
P333µm	1586	1442	90.92
S333µm	1698	787	46.35
BONGO (61cm) - Surface			
S165µm	6	0	0
P333µm	1043	1021	97.89
S333µm	1037	56	5.40
Total	6029	3306	54.83

Table 11. Gear type and the number of samples collected and processed as part of the Scotian Shelf Ichthyoplankton Program. For Gear/Tow Type, the numbers indicate the mesh size used, S indicates a starboard sample, P indicates the port sample and MARMAP stands for Marine Resources, Monitoring, Assessment and Prediction.

Gear/Tow Type	Total tows	Number of tows processed for fish and/or fish eggs	Proportion of total tows processed (%)
1m NET – Surface			
471µm	618	610	98.71
BONGO (61cm) – MARMAP Double Oblique			
P333µm	2818	2392	84.88
S333µm	2321	388	16.72
S471µm	497	0	0
BONGO (61cm) – Old Stepped Oblique			
P333µm	151	0	0
P471µm	864	367	42.48
S333µm	151	151	100
S471µm	864	460	53.24
BONGO (61cm) – Surface			
P333µm	1950	1785	91.54
S333µm	1950	133	6.82
NEUSTON – Surface			
333µm	176	172	97.73
1179µm	3422	3368	98.42
ISAACS-KIDD - MARMAP Double Oblique			
471µm	117	115	98.29
ISAACS-KIDD - Old Stepped Oblique			
471µm	1616	1561	96.60
ISAACS-KIDD – New Stepped Oblique			
471µm	540	527	97.59
SAMEOTO BOX NEUSTON - Surface			
405µm	251	251	100
Total	18306	12280	67.08

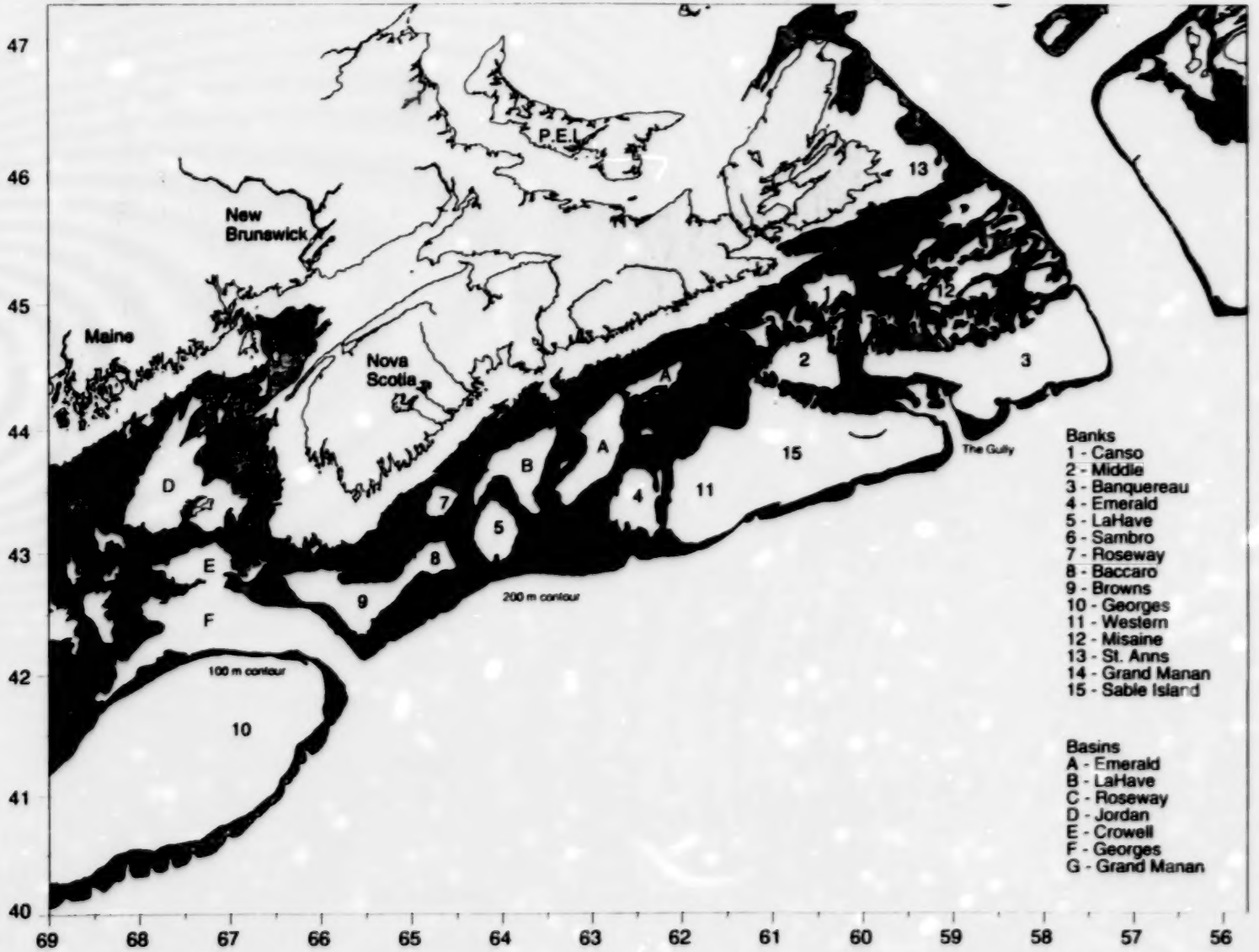
Table 12. Definition of the developmental stages of fish eggs as defined by Markle and Frost (1985).

Egg Stage	Stage Definition	Identification of Cod, Haddock and Witch Flounder
Stage I	from spawning until the visible formation of an embryonic axis about the mid gastrula	cod, haddock and witch cannot be distinguished
Stage II	from the end of stage I until the embryo is half way around the yolk sac, which corresponds approximately to the time of blastopore closure	cod, haddock and witch cannot be distinguished
Stage III	from the end of stage II until the tip of the tail reaches or could reach the snout	cod, haddock and witch can sometimes be distinguished, particularly in the latter portion of this stage
Stage IV	from the end of stage III until hatching	cod, haddock and witch can all be distinguished

Table 13. Initial processing codes for fish eggs, larvae and juveniles.

Code	Description
1	Identified and counted all fish and all fish eggs.
2	Identified and counted all fish and selected fish eggs.
3	Identified and counted all fish and no fish eggs.
4	Identified and counted selected fish and all fish eggs.
5	Identified and counted selected fish and selected fish eggs.
6	Identified and counted selected fish and no fish eggs.
7	Identified and counted no fish and all fish eggs.
8	Identified and counted no fish and selected fish eggs.
9	Identified and counted no fish and no fish eggs.
10	Sample lost in transit.
11	Sample rotten.
12	Sample hit bottom (full of sediment), not sorted.
13	Sample damaged while sorting.
14	Sample not sorted at present.
15	Sample not representative (tampered with or spilled).
16	Sorting information not available.

Fig. 1. Location of major physiographic features on the Scotian Shelf and Bay of Fundy.



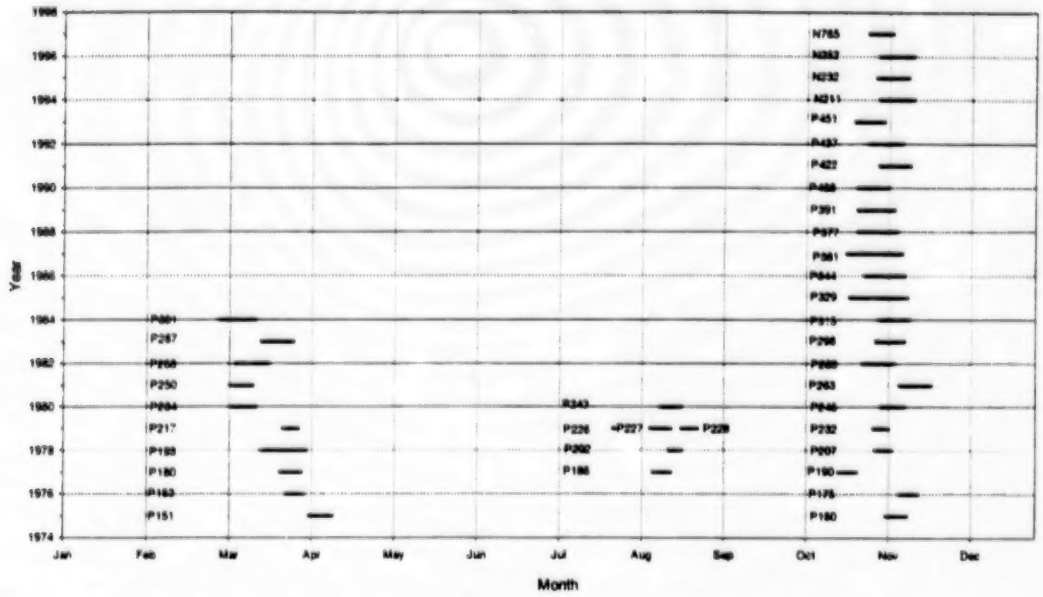


Fig. 2. Temporal coverage for LHP Bay of Fundy Cruises 1975 - 1997.

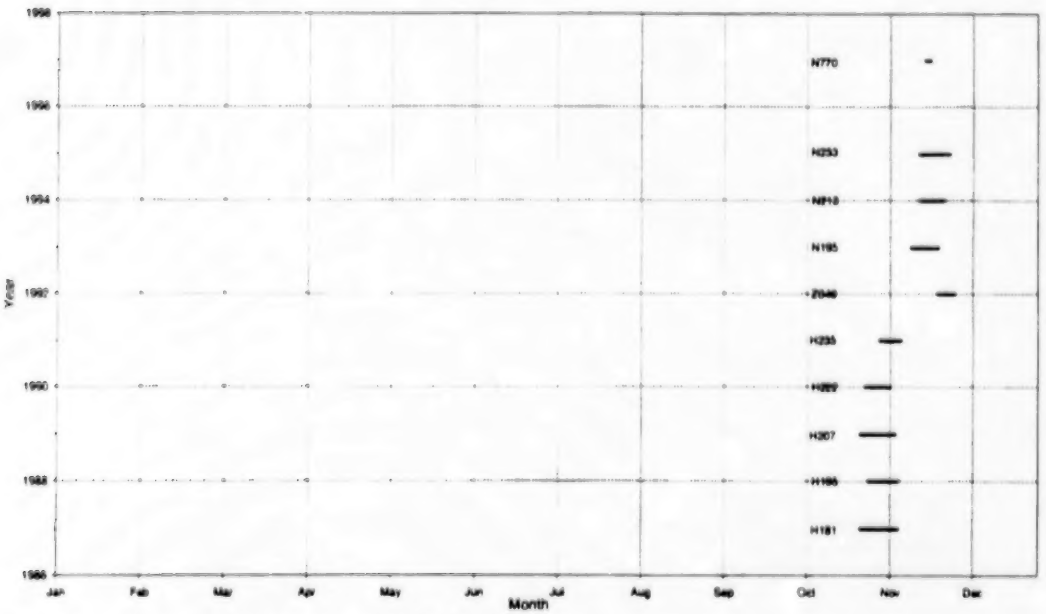


Fig. 3. Temporal coverage for LHP Georges Bank Cruises 1987 - 1997.

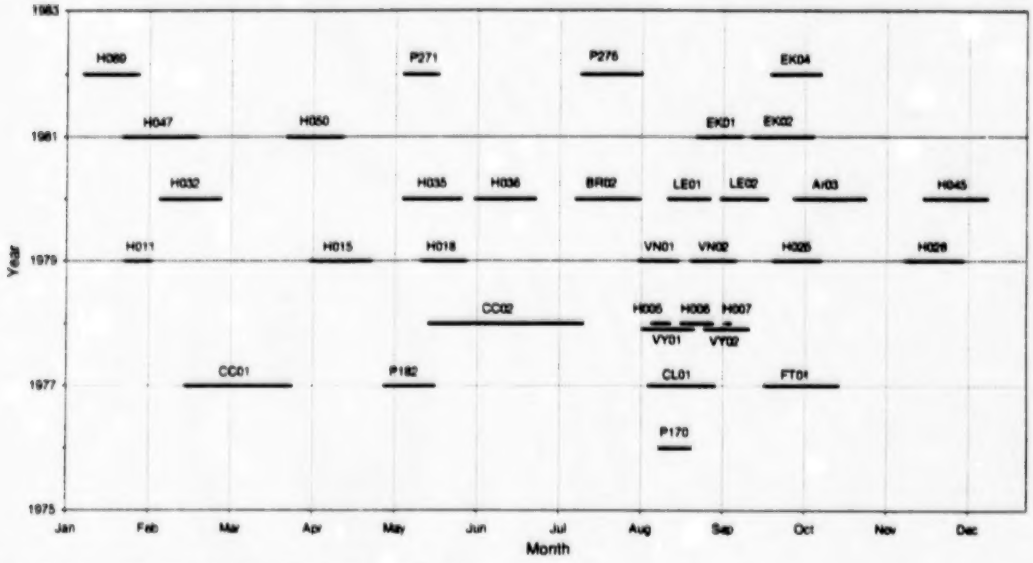


Fig. 4. Temporal coverage for SSIP Cruises 1976 - 1982.

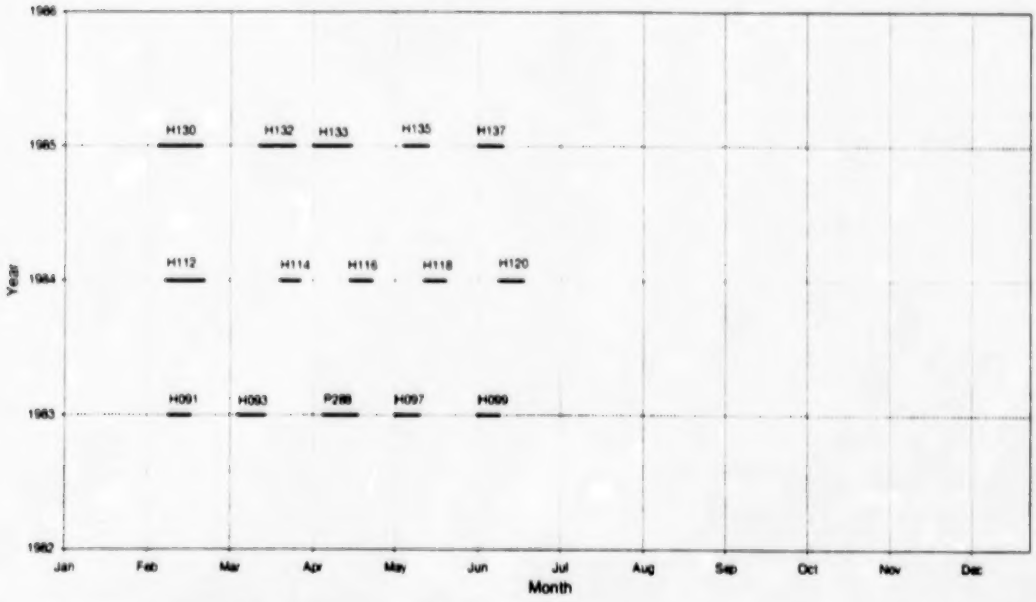


Fig. 5. Temporal coverage for FEP Cruises 1983 - 1985.

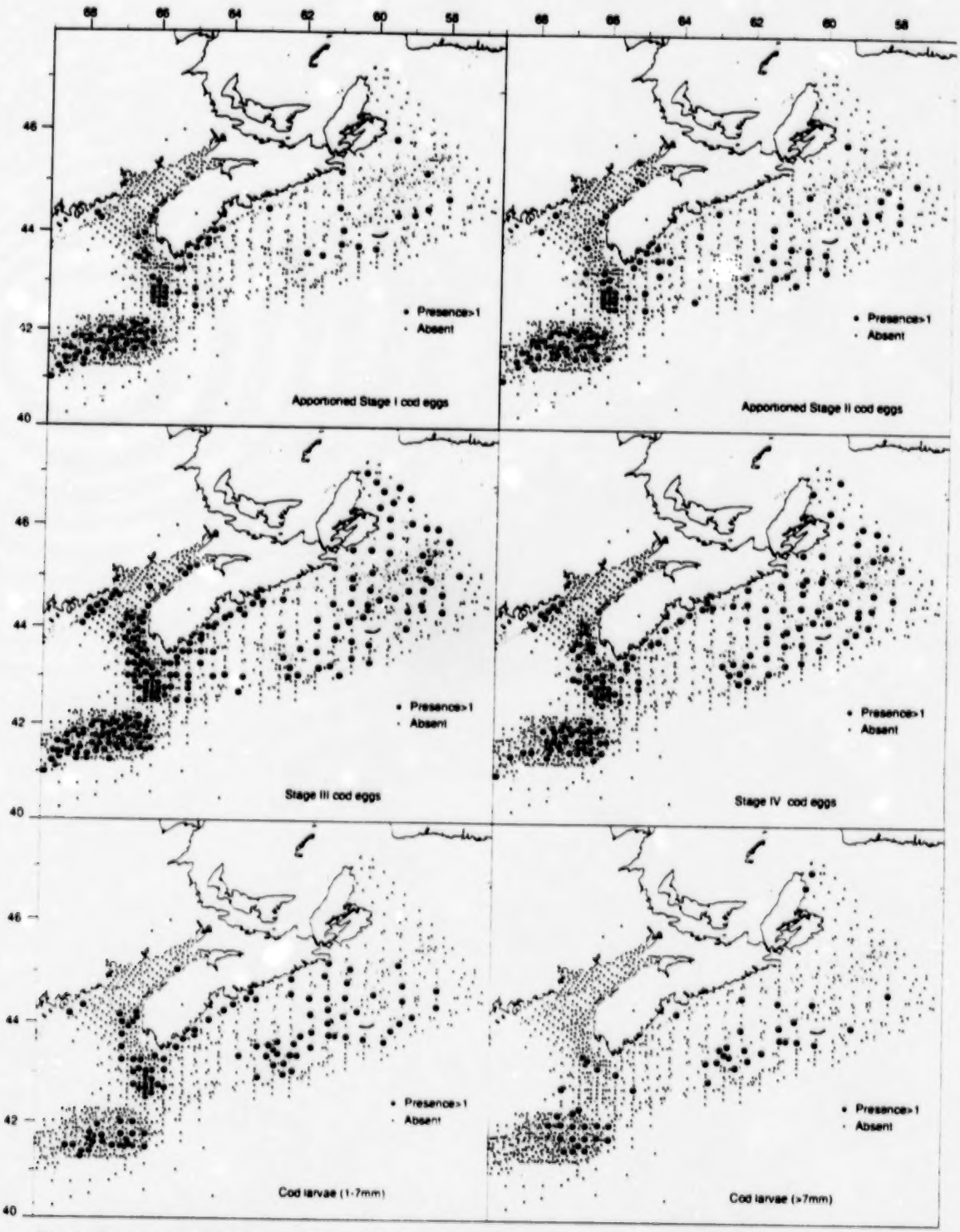


Fig. 6. Composite plot by life stage of all known cod ichthyoplankton data (Stage III and older) and apportioned cod/haddock/witch ichthyoplankton data (Stages I and II).

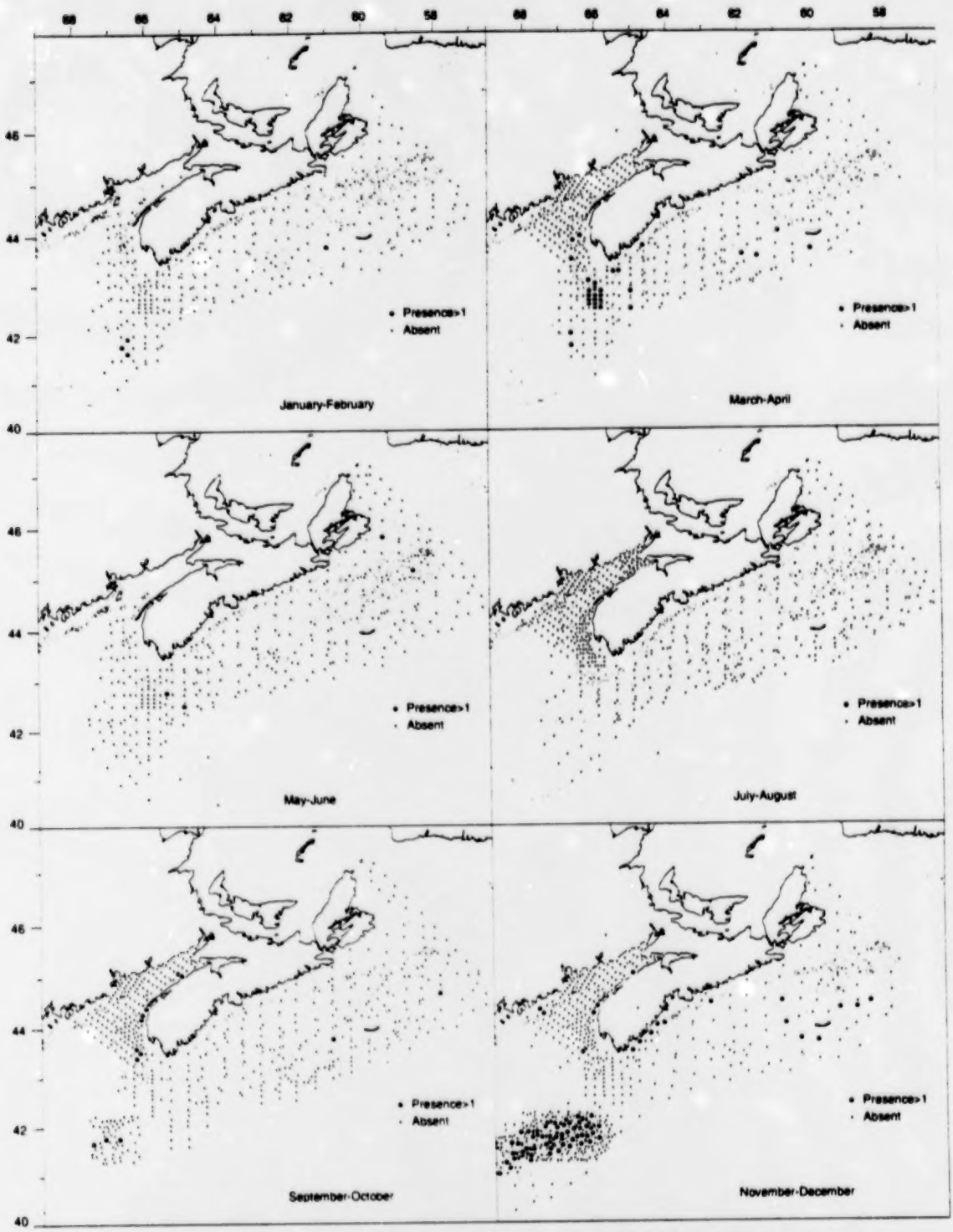


Fig. 7.1. Bimonthly composite plots of Stage I apportioned cod/haddock/witch eggs for stations sampled in all years and all programs.

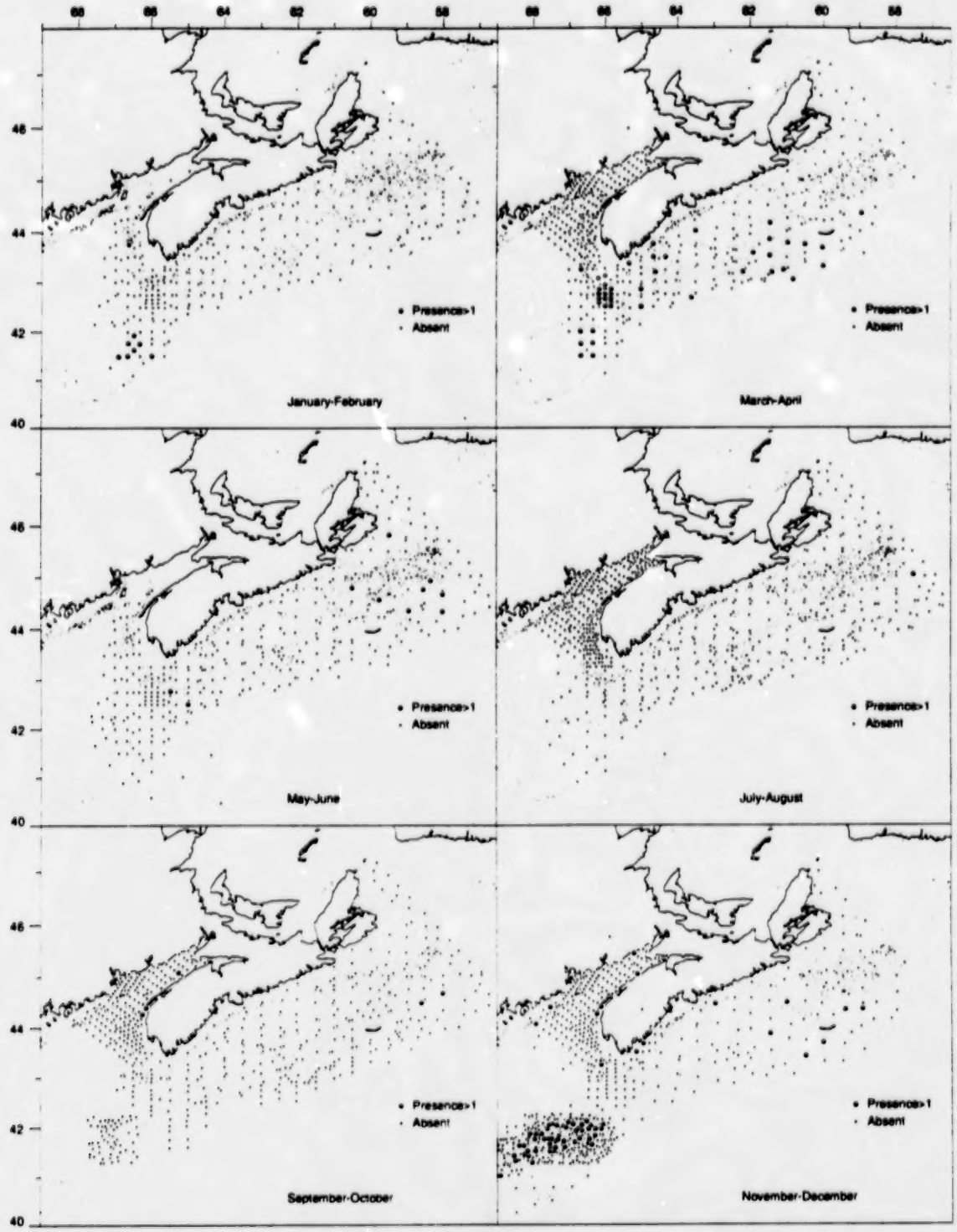


Fig. 7.2. Bimonthly composite plots of Stage II apportioned cod/haddock/witch eggs for stations sampled in all years and all programs.

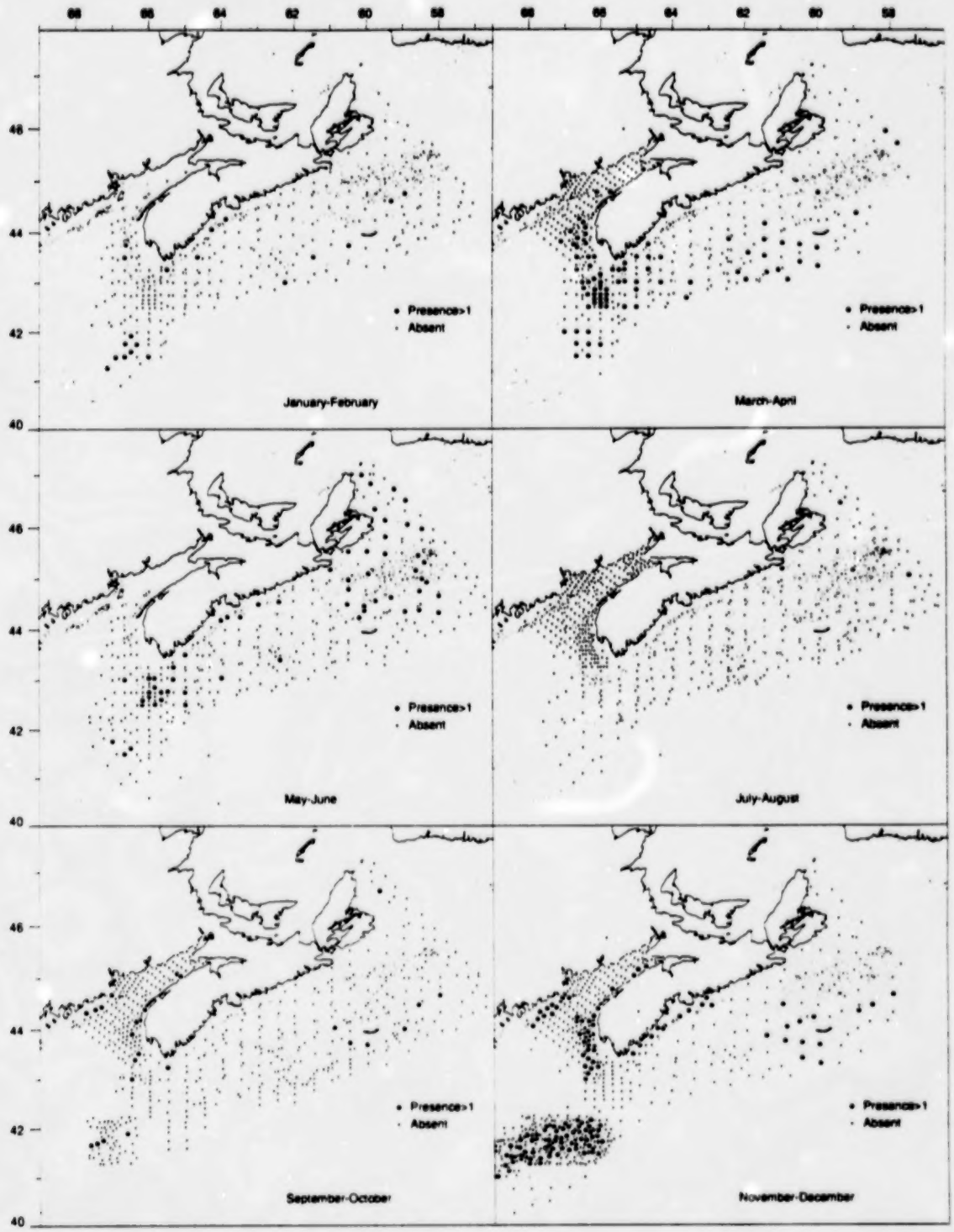


Fig. 7.3. Bimonthly composite plots of Stage III cod eggs for stations sampled in all years and all programs.

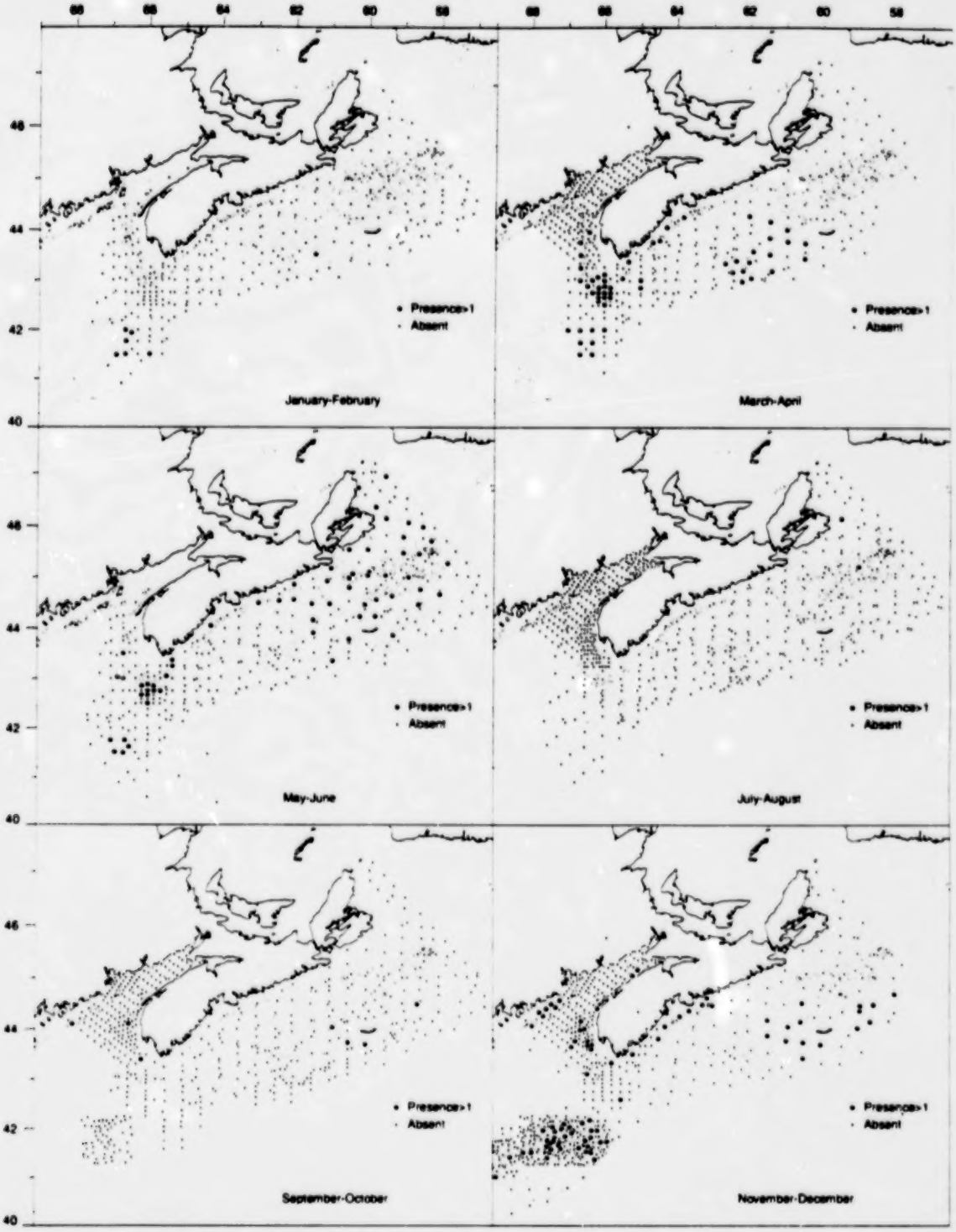


Fig. 7.4. Bimonthly composite plots of Stage IV cod eggs for stations sampled in all years and all programs.

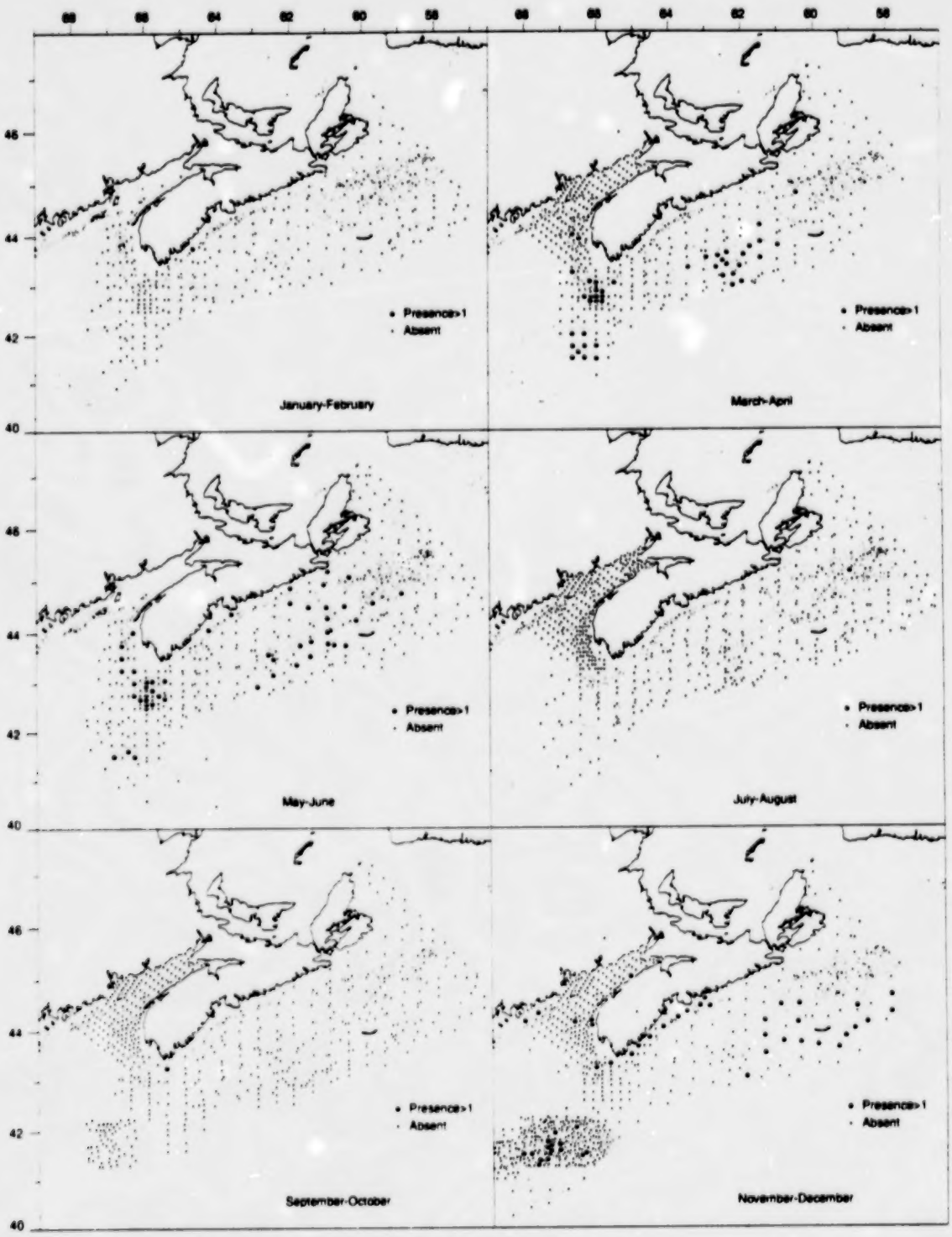


Fig. 7.5. Bimonthly composite plots of cod larvae (1-7mm) for stations sampled in all years and all programs.

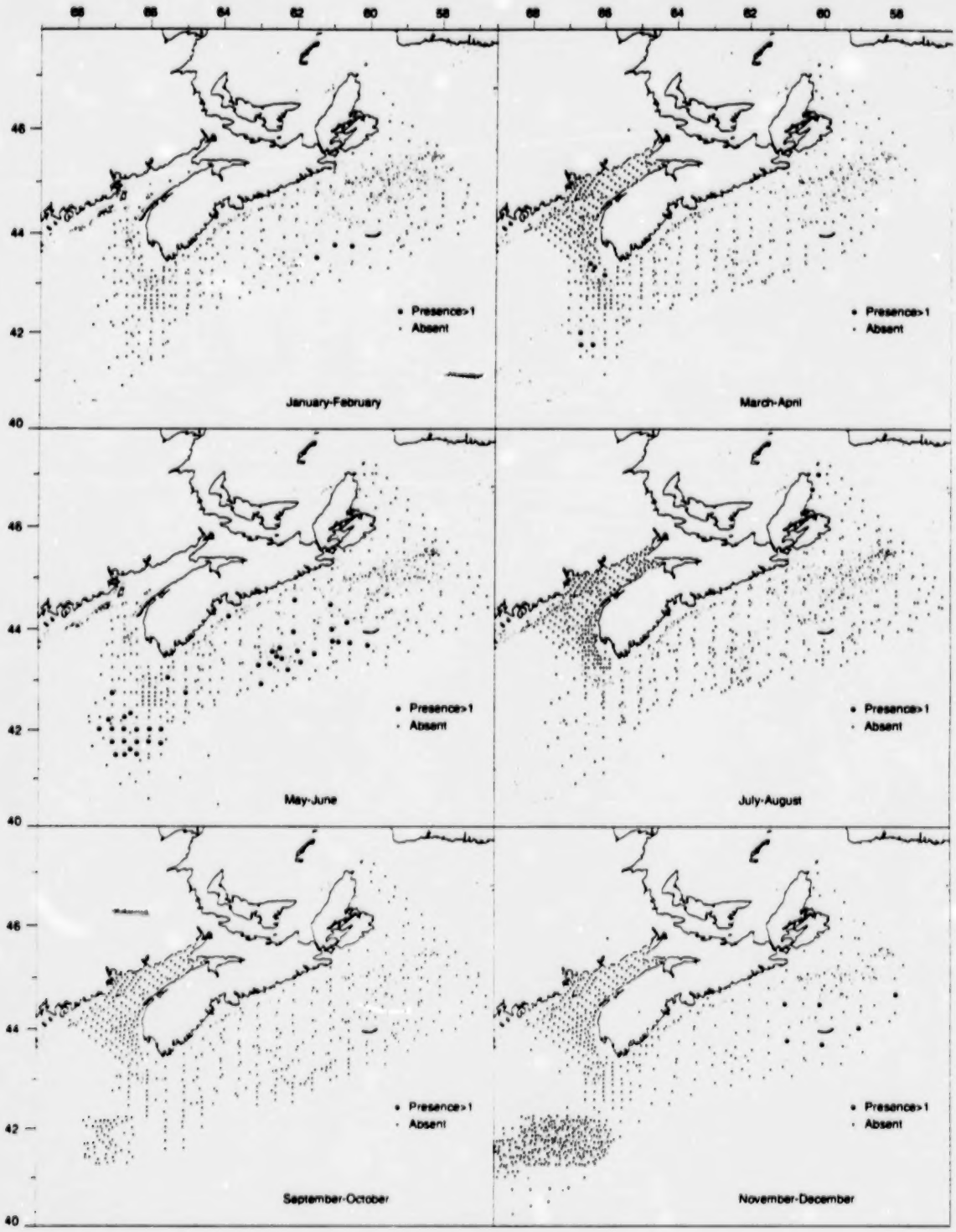


Fig. 7.6. Bimonthly composite plots of cod larvae (>7mm) for stations sampled in all years and all programs.

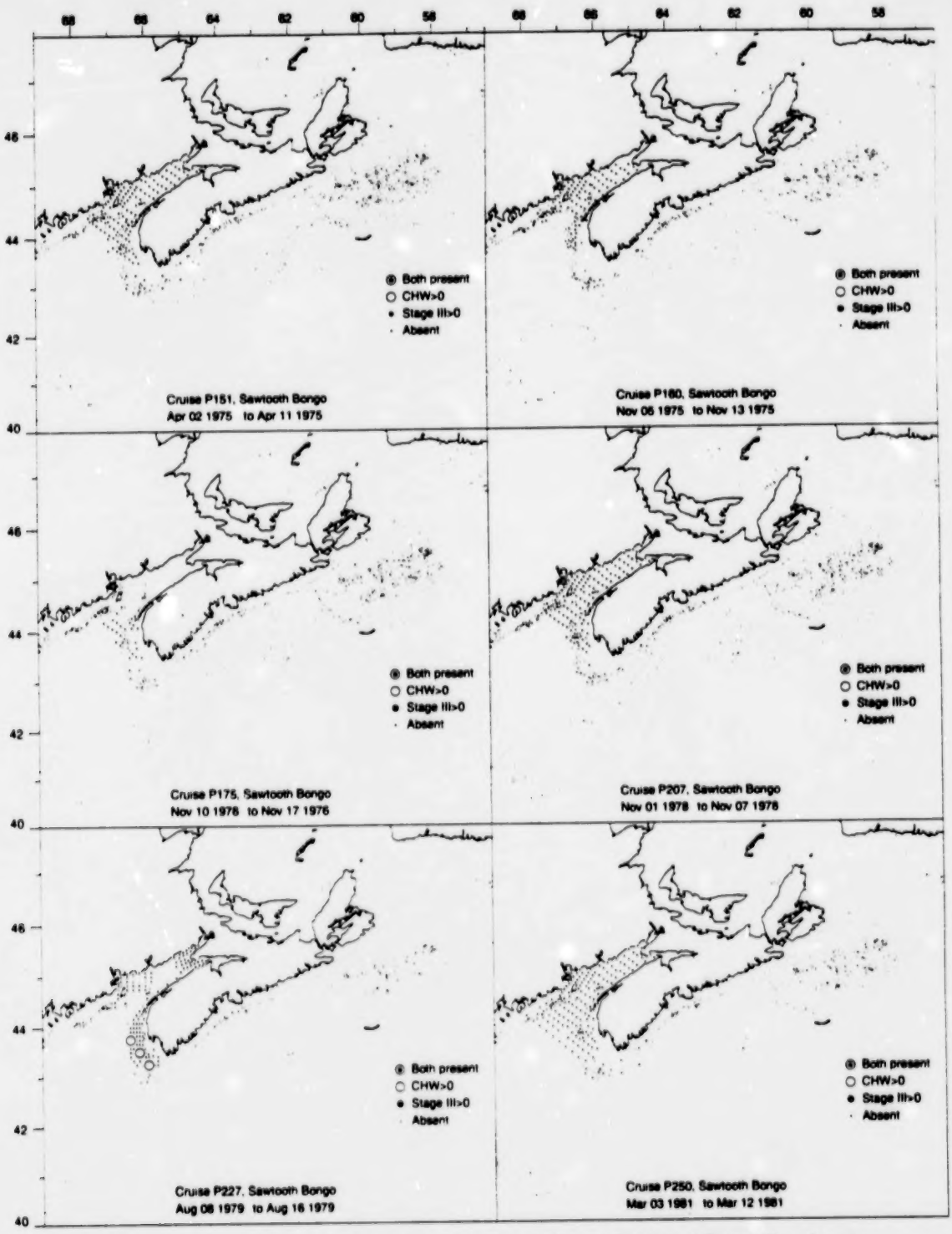

Both present
CHW>0
Stage III>0
Absent
Cruise P151, Sawtooth Bongo
Apr 02 1975 to Apr 11 1975
Cruise P160, Sawtooth Bongo
Nov 06 1975 to Nov 13 1975
Cruise P175, Sawtooth Bongo
Nov 10 1976 to Nov 17 1976
Cruise P207, Sawtooth Bongo
Nov 01 1978 to Nov 07 1978
Cruise P227, Sawtooth Bongo
Aug 08 1979 to Aug 16 1979
Cruise P250, Sawtooth Bongo
Mar 03 1981 to Mar 12 1981

Fig. 8.1.1. Larval Herring Program-Bay of Fundy Cruises: Stage I CHW and Stage III cod eggs.

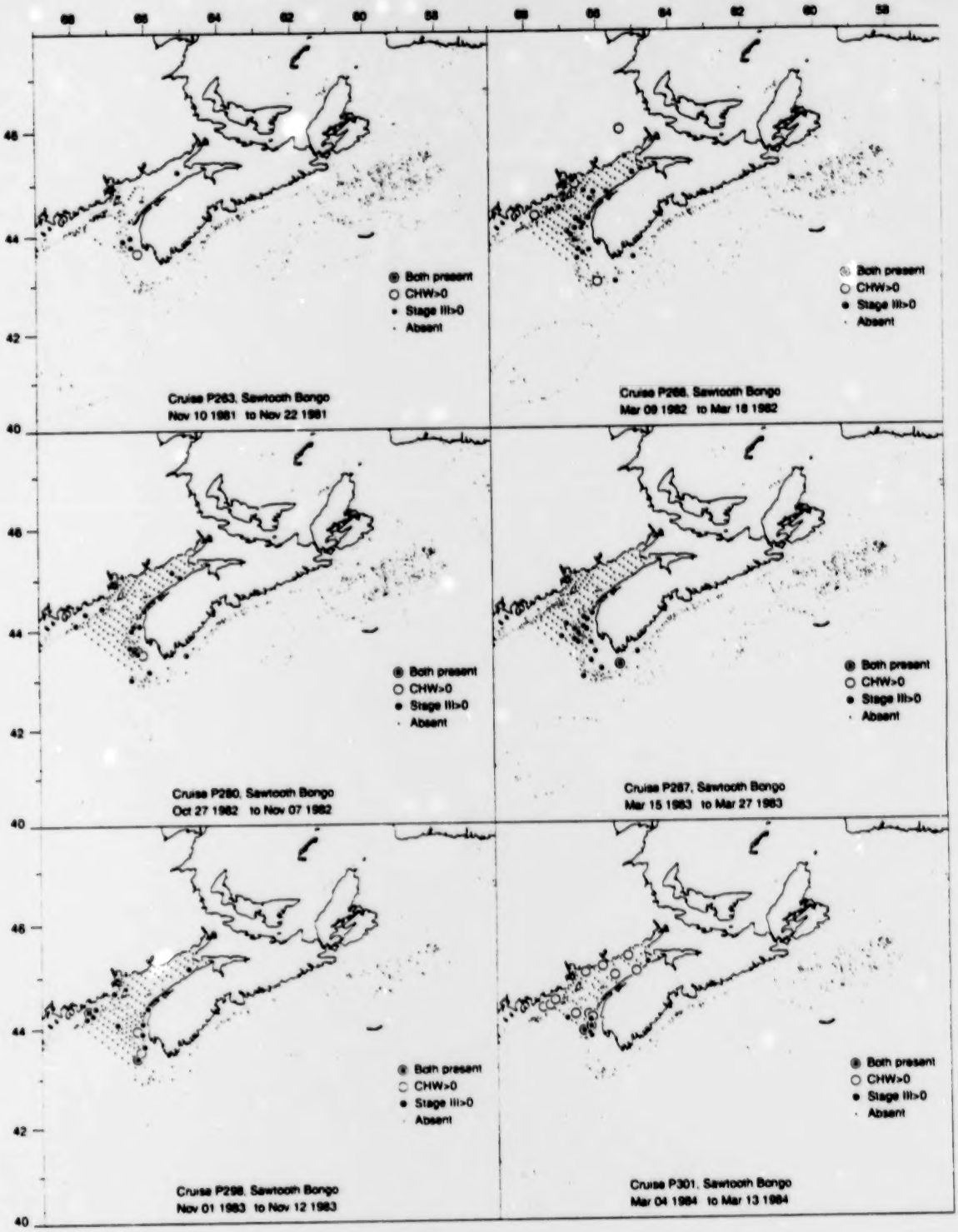

Both present
CHW>0
Stage III>0
Absent
Cruise P283, Sawtooth Bongo
Nov 10 1981 to Nov 22 1981
Cruise P286, Sawtooth Bongo
Mar 09 1982 to Mar 18 1982
Cruise P290, Sawtooth Bongo
Oct 27 1982 to Nov 07 1982
Cruise P297, Sawtooth Bongo
Mar 15 1983 to Mar 27 1983
Cruise P298, Sawtooth Bongo
Nov 01 1983 to Nov 12 1983
Cruise P301, Sawtooth Bongo
Mar 04 1984 to Mar 13 1984

Fig. 8.1.1. (continued).

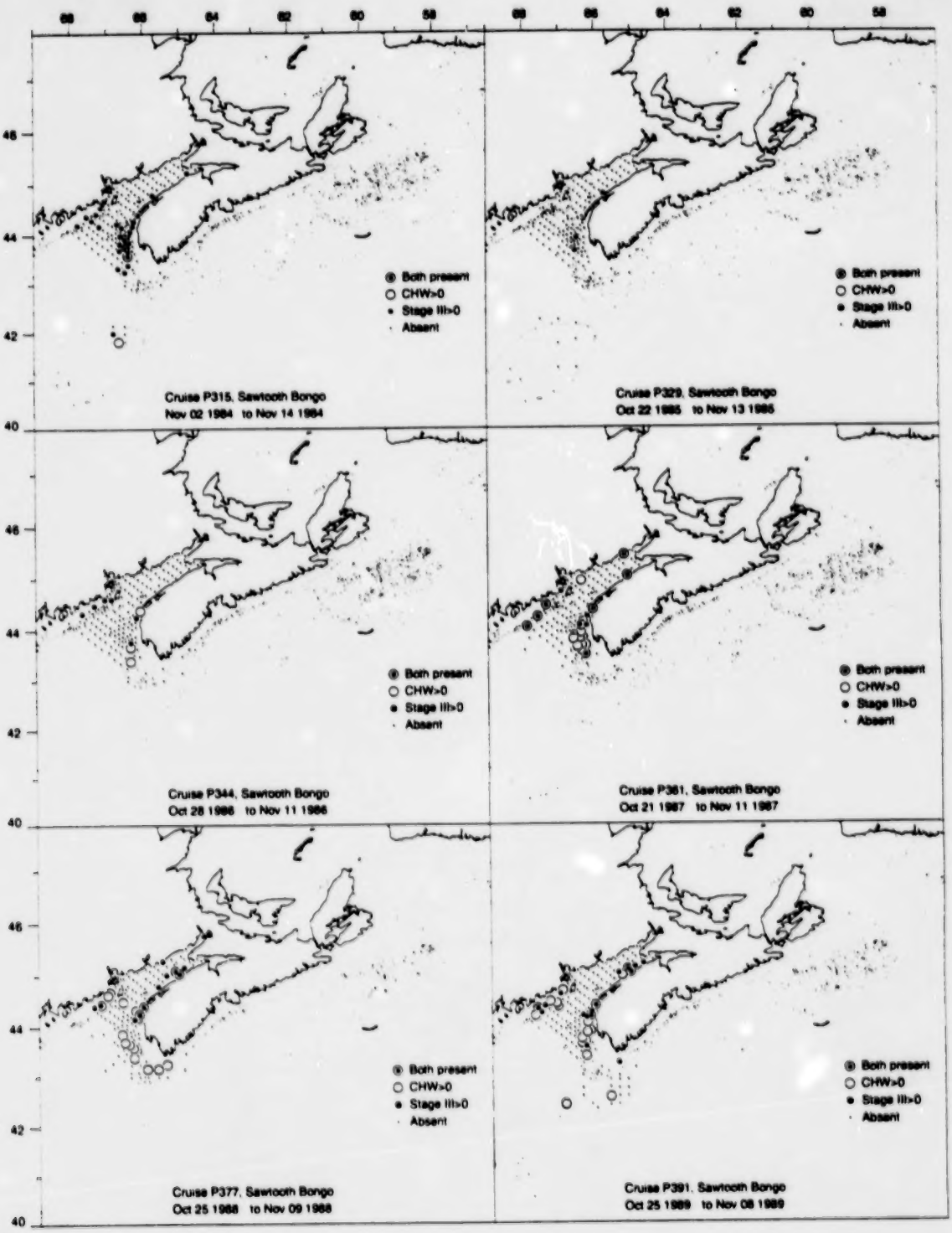

Both present
CHW>0
Stage III>0
Absent
Cruise P315, Sawtooth Bongo
Nov 02 1984 to Nov 14 1984
Cruise P329, Sawtooth Bongo
Oct 22 1985 to Nov 13 1985
Cruise P344, Sawtooth Bongo
Oct 28 1986 to Nov 11 1986
Cruise P361, Sawtooth Bongo
Oct 21 1987 to Nov 11 1987
Cruise P377, Sawtooth Bongo
Oct 25 1988 to Nov 09 1988
Cruise P391, Sawtooth Bongo
Oct 25 1989 to Nov 08 1989

Fig. 8.1.1. (continued).

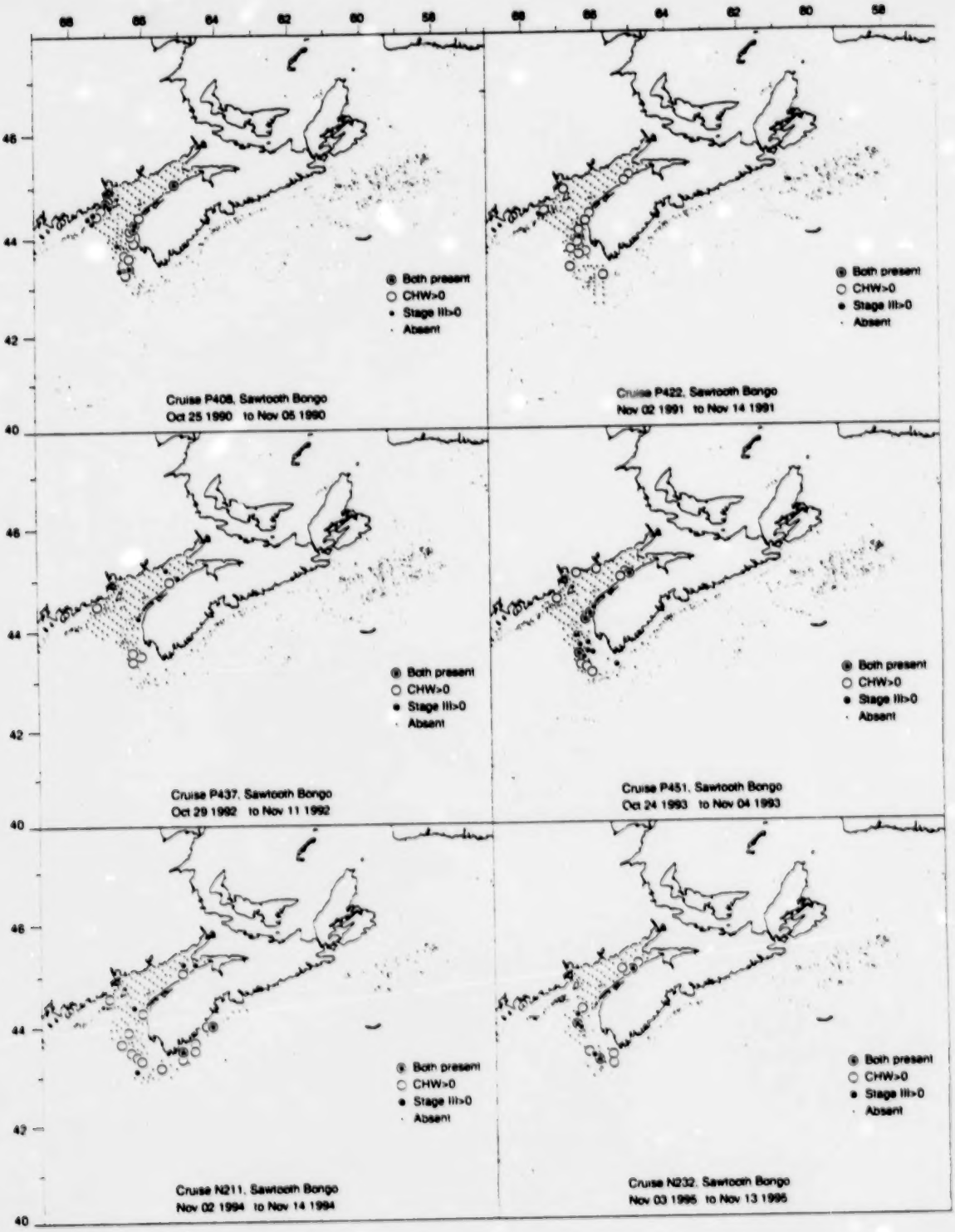

Both present
CHW>0
Stage III>0
Absent
Cruise P408. Sawtooth Bongo
Oct 25 1990 to Nov 05 1990
Cruise P422. Sawtooth Bongo
Nov 02 1991 to Nov 14 1991
Cruise P437. Sawtooth Bongo
Oct 29 1992 to Nov 11 1992
Cruise P451. Sawtooth Bongo
Oct 24 1993 to Nov 04 1993
Cruise N211. Sawtooth Bongo
Nov 02 1994 to Nov 14 1994
Cruise N232. Sawtooth Bongo
Nov 03 1995 to Nov 13 1995

Fig. 8.1.1. (continued).

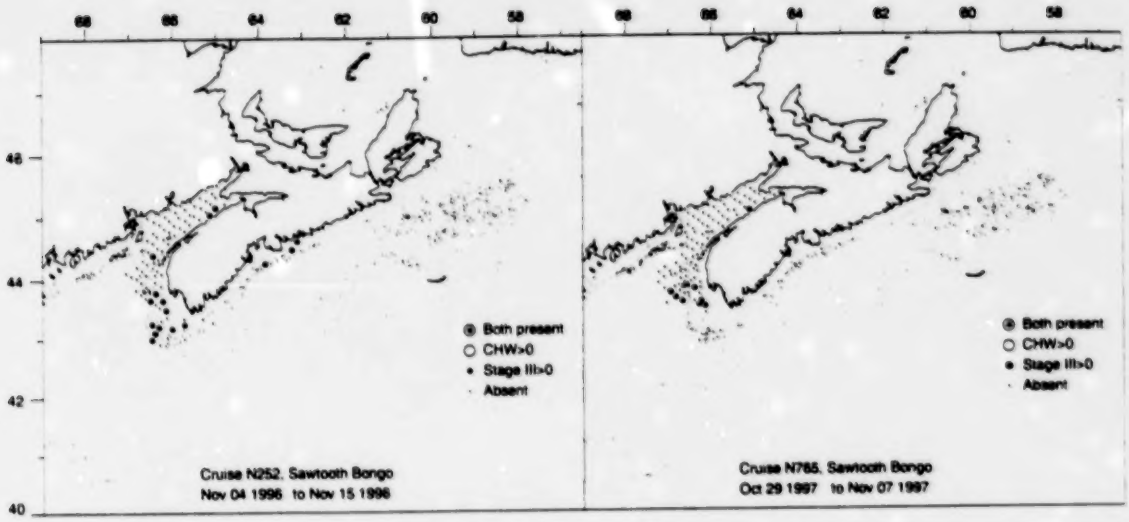


Fig. 8.1.1. (continued).

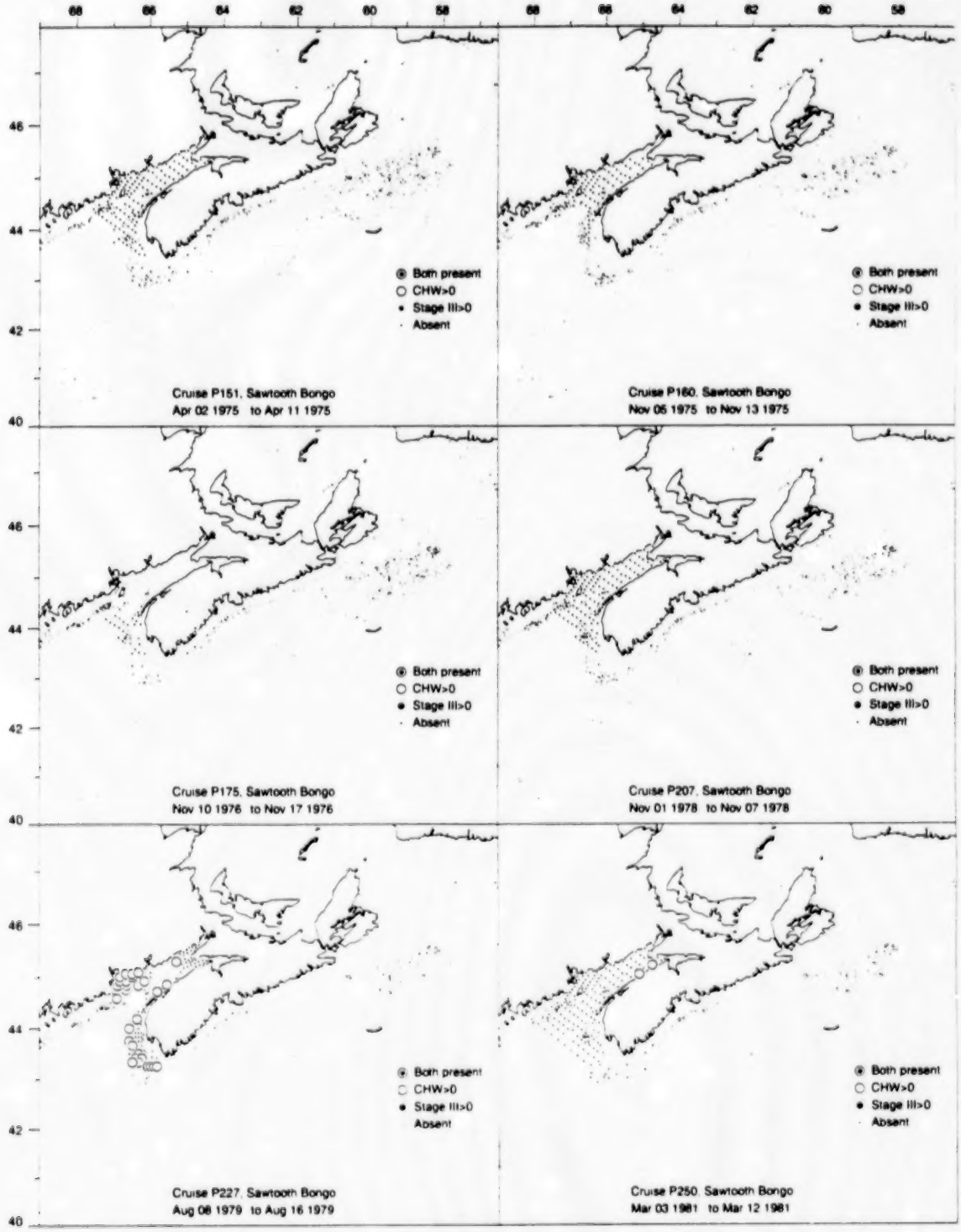

Both present
CHW>0
Stage III>0
Absent
Cruise P151. Sawtooth Bongo
Apr 02 1975 to Apr 11 1975
Cruise P160. Sawtooth Bongo
Nov 05 1975 to Nov 13 1975
Cruise P175. Sawtooth Bongo
Nov 10 1976 to Nov 17 1976
Cruise P207. Sawtooth Bongo
Nov 01 1978 to Nov 07 1978
Cruise P227. Sawtooth Bongo
Aug 08 1979 to Aug 16 1979
Cruise P250. Sawtooth Bongo
Mar 03 1981 to Mar 12 1981

Fig. 8.1.2. Larval Herring Program-Bay of Fundy Cruises: Stage II CHW and Stage III cod eggs.

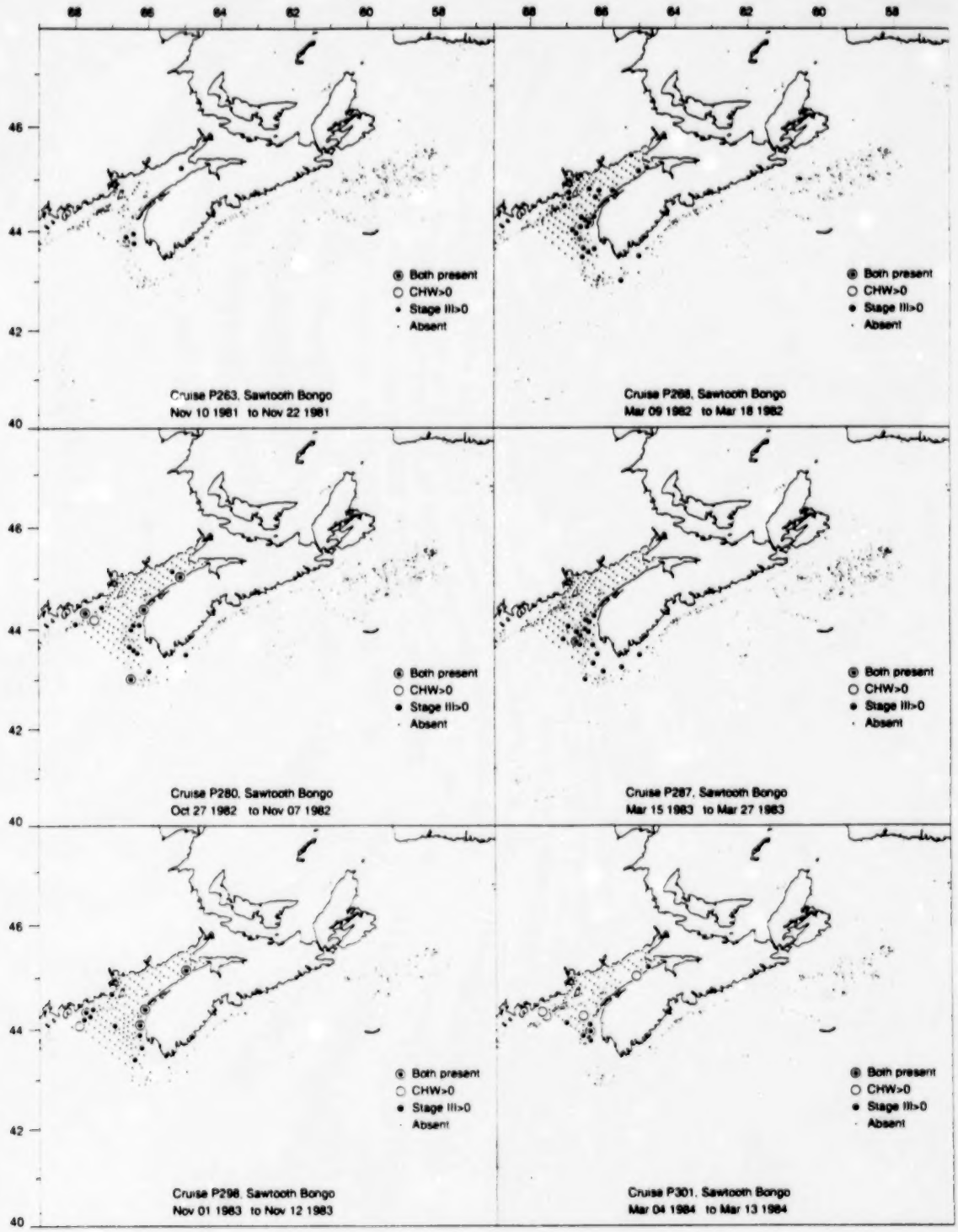


Fig. 8.1.2. (continued).

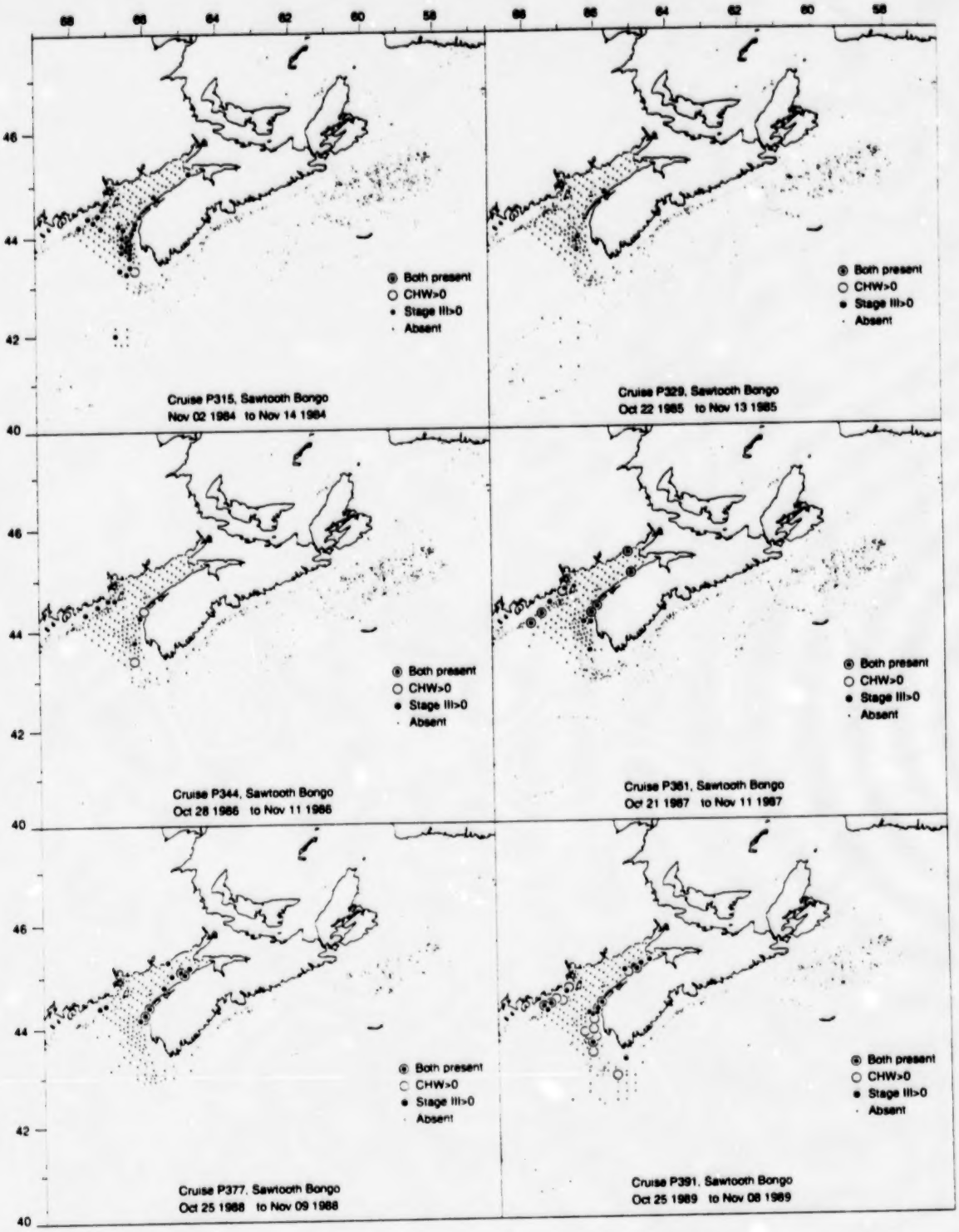

Both present
CHW>0
Stage III>0
Absent
Cruise P315, Sawtooth Bongo
Nov 02 1984 to Nov 14 1984
Cruise P329, Sawtooth Bongo
Oct 22 1985 to Nov 13 1985
Cruise P344, Sawtooth Bongo
Oct 28 1986 to Nov 11 1986
Cruise P361, Sawtooth Bongo
Oct 21 1987 to Nov 11 1987
Cruise P377, Sawtooth Bongo
Oct 25 1988 to Nov 09 1988
Cruise P391, Sawtooth Bongo
Oct 25 1989 to Nov 08 1989

Fig. 8.1.2. (continued).

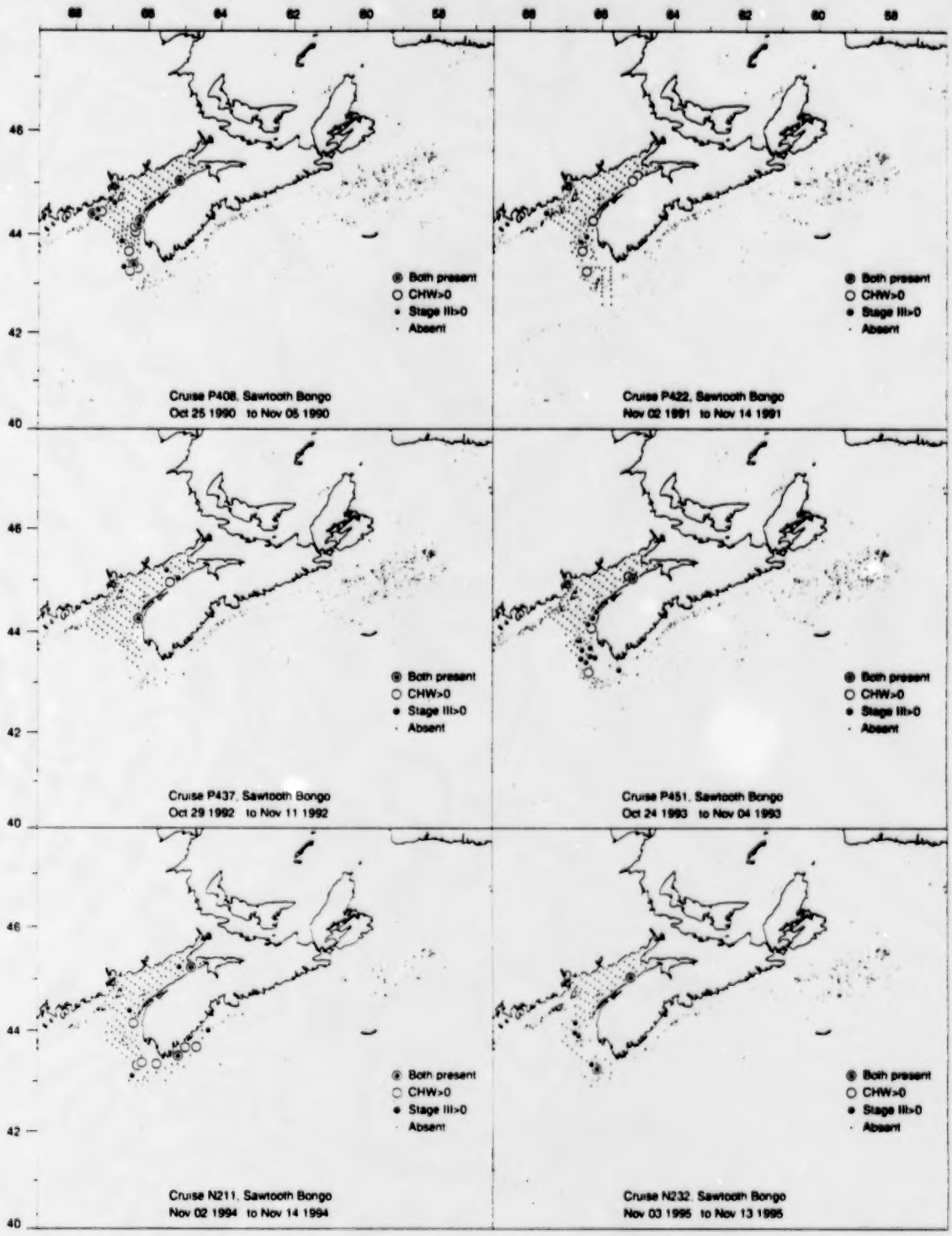

Both present
CHW>0
Stage III>0
Absent
Cruise P408. Sawtooth Bongo
Oct 25 1990 to Nov 05 1990
Cruise P422. Sawtooth Bongo
Nov 02 1991 to Nov 14 1991
Cruise P437. Sawtooth Bongo
Oct 29 1992 to Nov 11 1992
Cruise P451. Sawtooth Bongo
Oct 24 1993 to Nov 04 1993
Cruise N211. Sawtooth Bongo
Nov 02 1994 to Nov 14 1994
Cruise N232. Sawtooth Bongo
Nov 03 1995 to Nov 13 1995

Fig. 8.1.2. (continued).

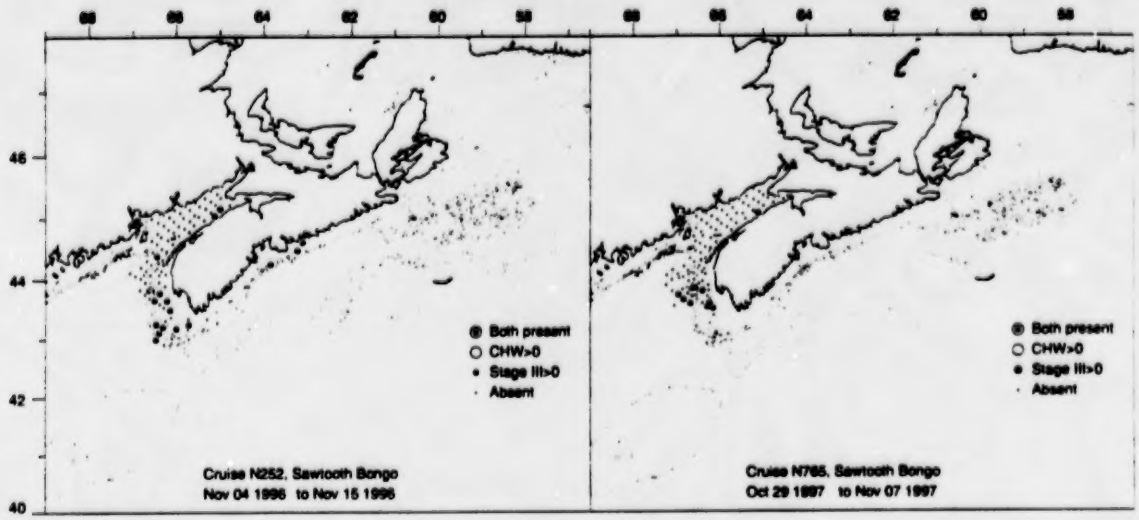


Fig. 8.1.2. (continued).

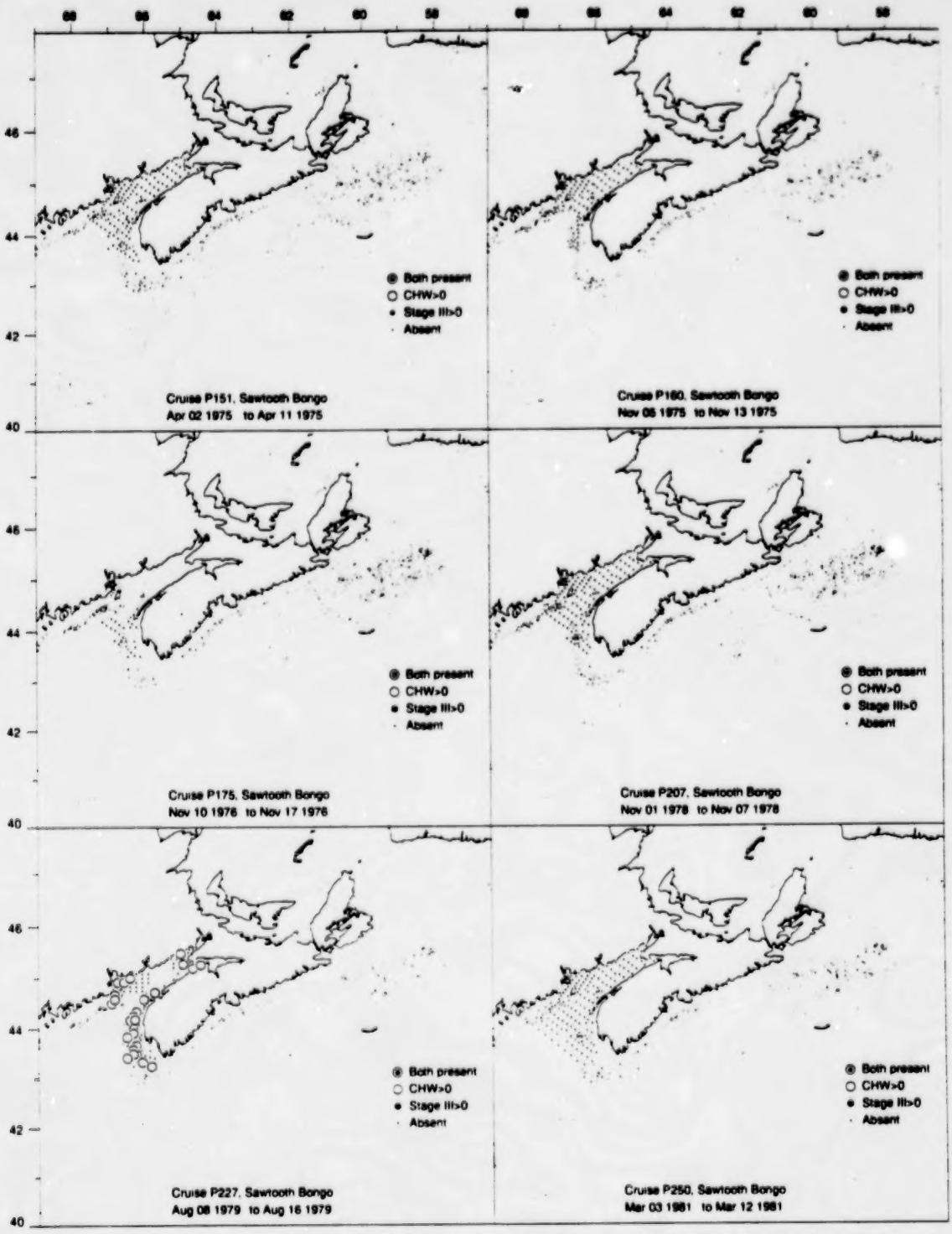

Both present
CHW>0
Stage III>0
Absent
Cruise P151. Sawtooth Bongo
Apr 02 1975 to Apr 11 1975
Cruise P160. Sawtooth Bongo
Nov 05 1975 to Nov 13 1975
Cruise P175. Sawtooth Bongo
Nov 10 1976 to Nov 17 1976
Cruise P207. Sawtooth Bongo
Nov 01 1978 to Nov 07 1978
Cruise P227. Sawtooth Bongo
Aug 08 1979 to Aug 16 1979
Cruise P250. Sawtooth Bongo
Mar 03 1981 to Mar 12 1981

Fig. 8.1.3. Larval Herring Program-Bay of Fundy Cruises: Stage III CHW and Stage III cod eggs.

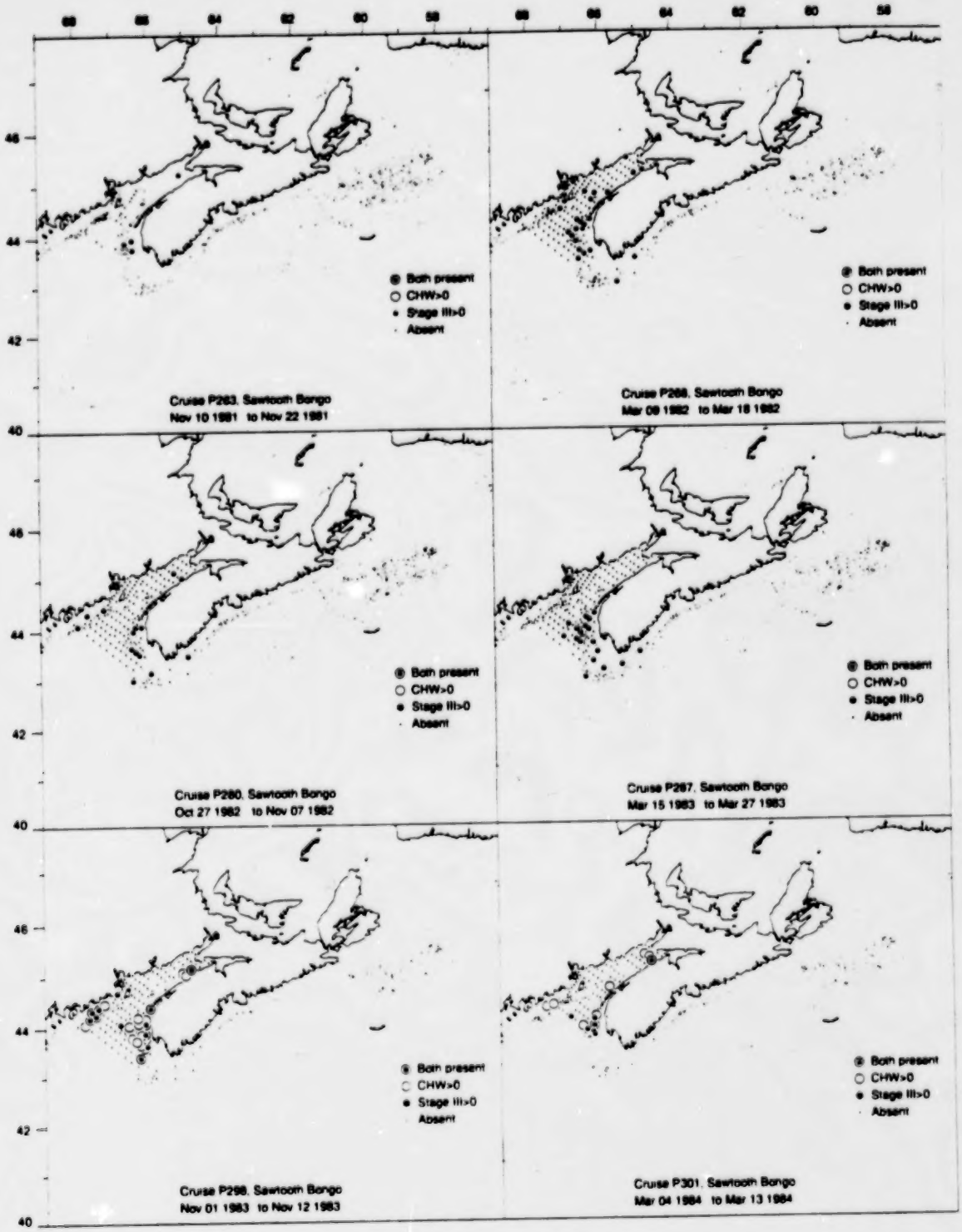

Both present
CHW>0
Stage III>0
Absent
Cruise P263. Sawtooth Bongo
Nov 10 1981 to Nov 22 1981
Cruise P268. Sawtooth Bongo
Mar 09 1982 to Mar 18 1982
Cruise P280. Sawtooth Bongo
Oct 27 1982 to Nov 07 1982
Cruise P287. Sawtooth Bongo
Mar 15 1983 to Mar 27 1983
Cruise P298. Sawtooth Bongo
Nov 01 1983 to Nov 12 1983
Cruise P301. Sawtooth Bongo
Mar 04 1984 to Mar 13 1984

Fig. 8.1.3. (continued).

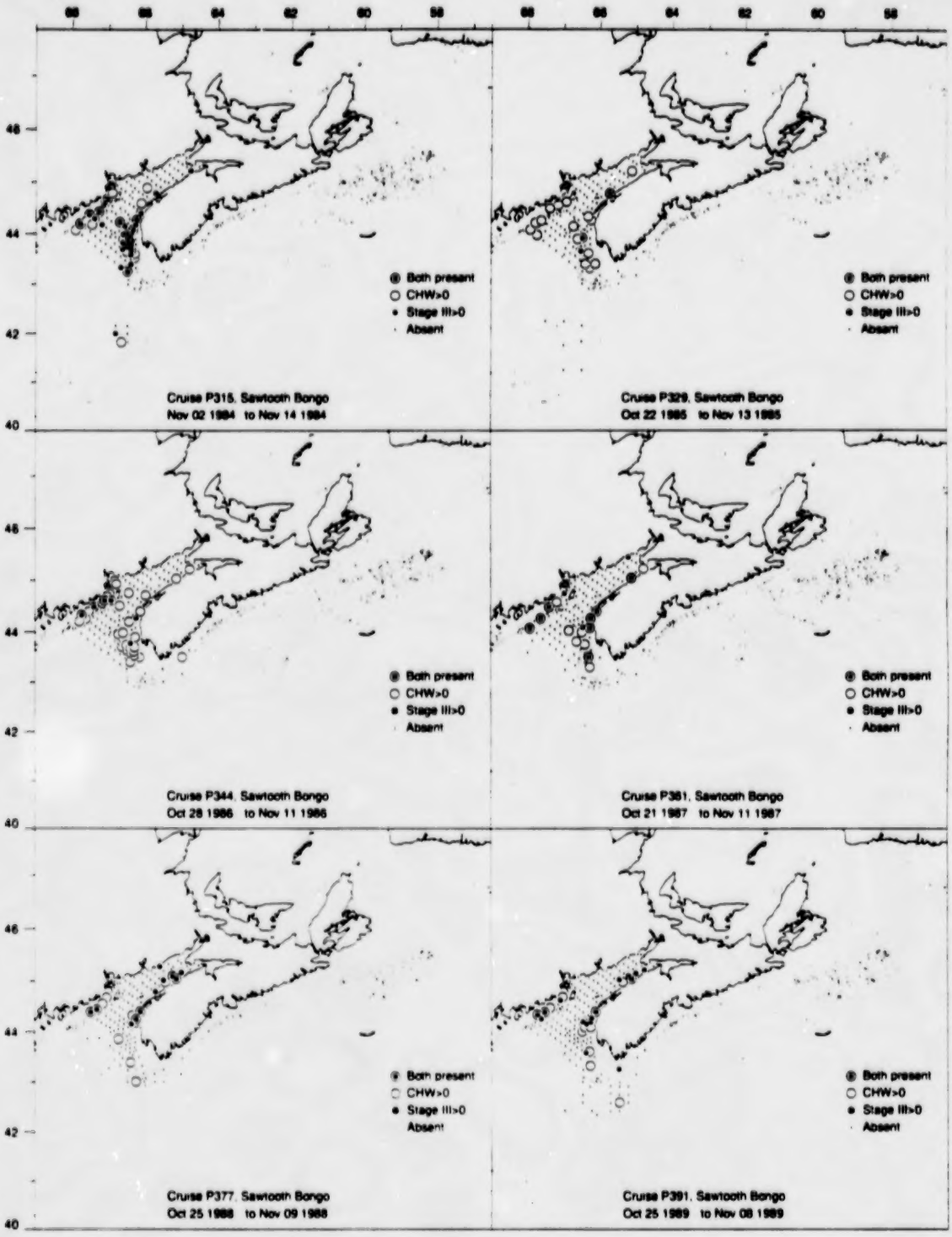

Both present
CHW>0
Stage III>0
Absent
Cruise P315. Sawtooth Bongo
Nov 02 1984 to Nov 14 1984
Cruise P329. Sawtooth Bongo
Oct 22 1985 to Nov 13 1985
Cruise P344. Sawtooth Bongo
Oct 28 1986 to Nov 11 1986
Cruise P361. Sawtooth Bongo
Oct 21 1987 to Nov 11 1987
Cruise P377. Sawtooth Bongo
Oct 25 1988 to Nov 09 1988
Cruise P391. Sawtooth Bongo
Oct 25 1989 to Nov 08 1989

Fig. 8.1.3. (continued).

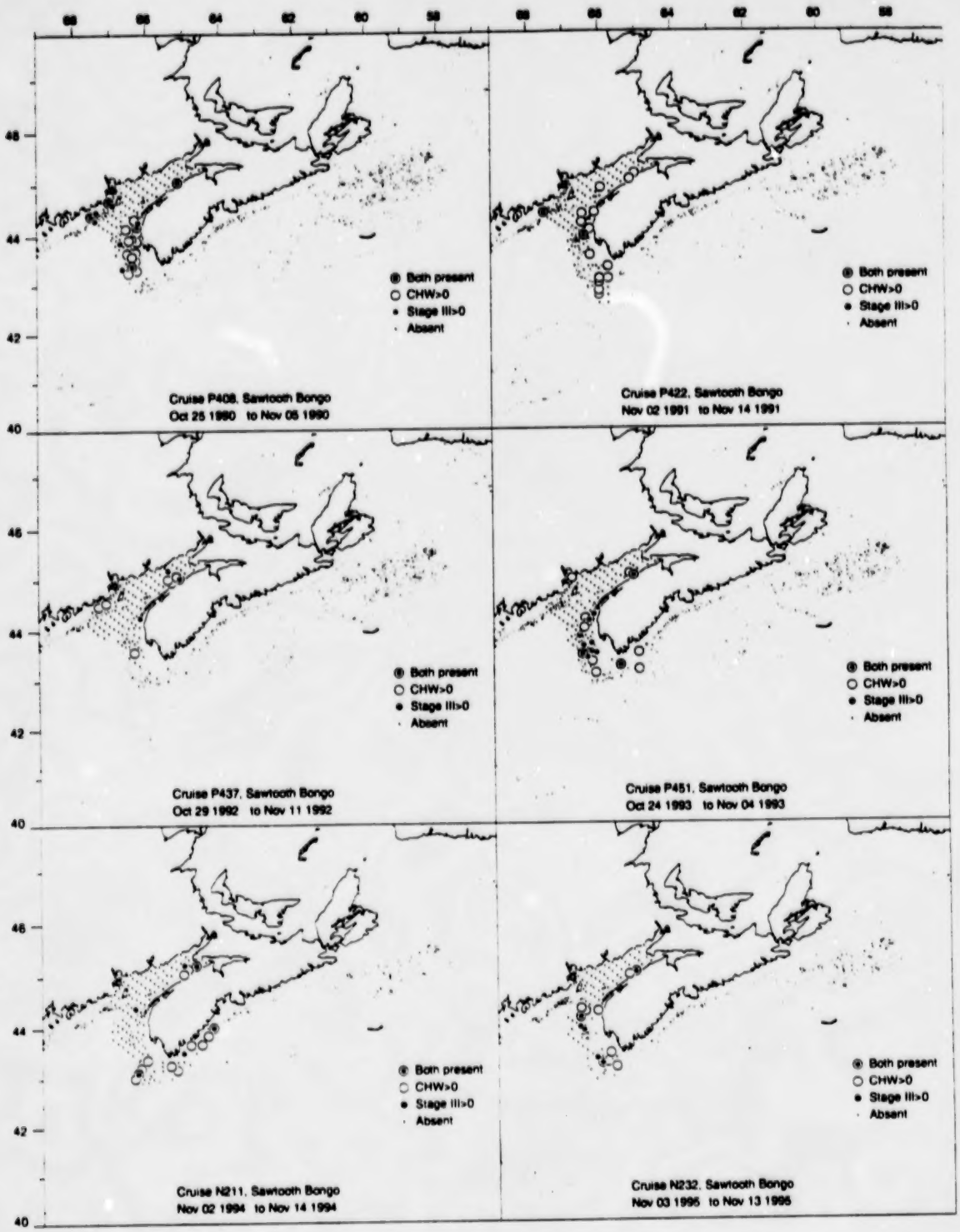

Both present
CHW>0
Stage III>0
Absent
Cruise P408. Sawtooth Bongo
Oct 25 1990 to Nov 05 1990
Cruise P422. Sawtooth Bongo
Nov 02 1991 to Nov 14 1991
Cruise P437. Sawtooth Bongo
Oct 29 1992 to Nov 11 1992
Cruise P451. Sawtooth Bongo
Oct 24 1993 to Nov 04 1993
Cruise N211. Sawtooth Bongo
Nov 02 1994 to Nov 14 1994
Cruise N232. Sawtooth Bongo
Nov 03 1995 to Nov 13 1995

Fig. 8.1.3. (continued).

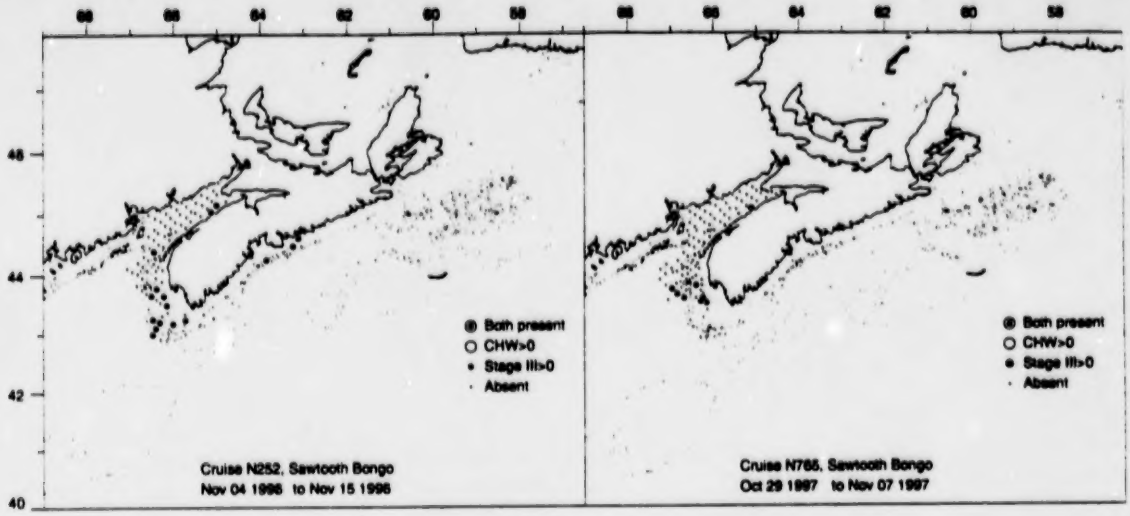


Fig. 8.1.3. (continued).

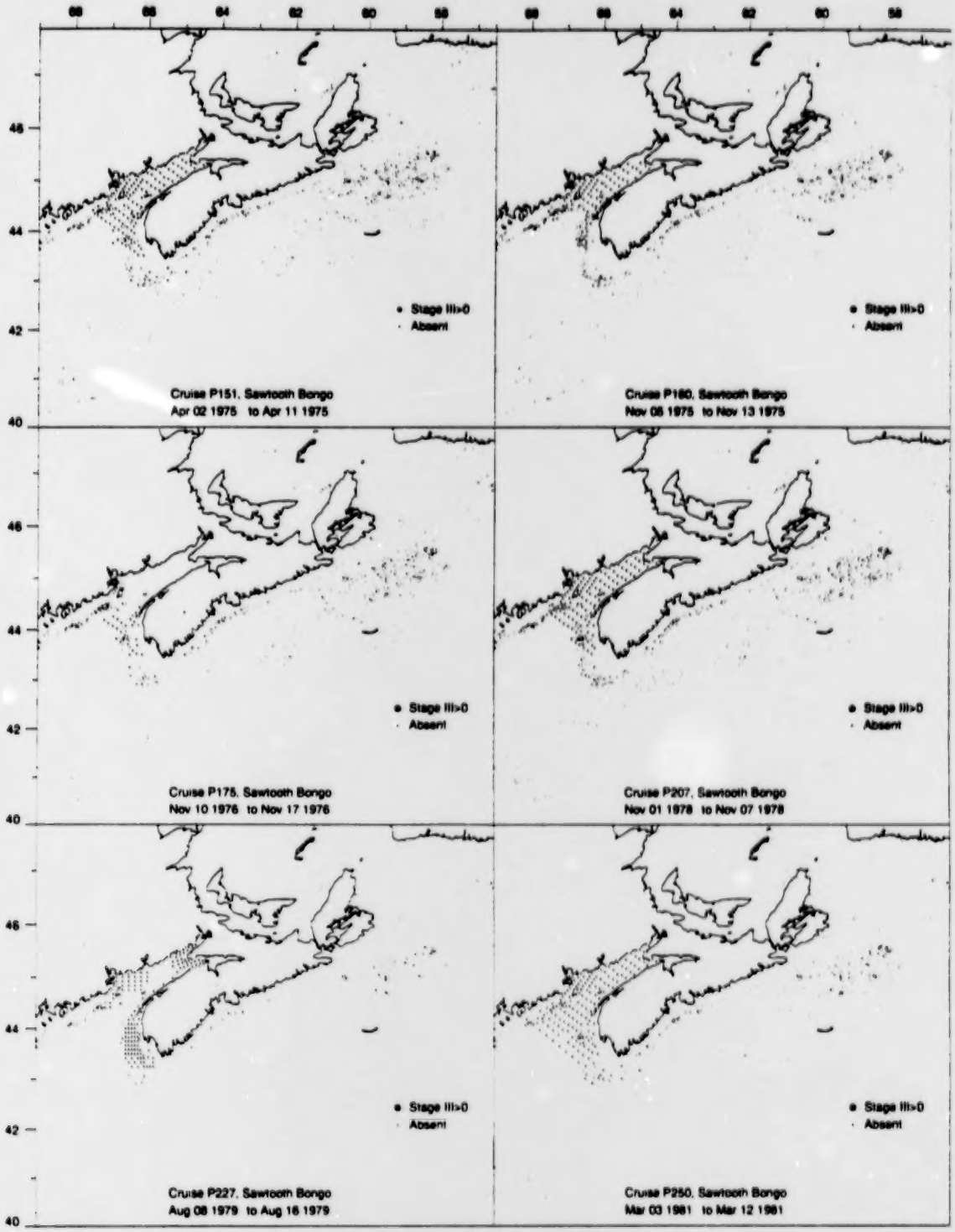

Stage III>0
Absent
Cruise P151, Sawtooth Bongo
Apr 02 1975 to Apr 11 1975
Cruise P160, Sawtooth Bongo
Nov 08 1975 to Nov 13 1975
Cruise P175, Sawtooth Bongo
Nov 10 1976 to Nov 17 1976
Cruise P207, Sawtooth Bongo
Nov 01 1978 to Nov 07 1978
Cruise P227, Sawtooth Bongo
Aug 08 1979 to Aug 16 1979
Cruise P250, Sawtooth Bongo
Mar 03 1981 to Mar 12 1981

Fig. 8.1.4. Larval Herring Program-Bay of Fundy Cruises: Stage III cod eggs.

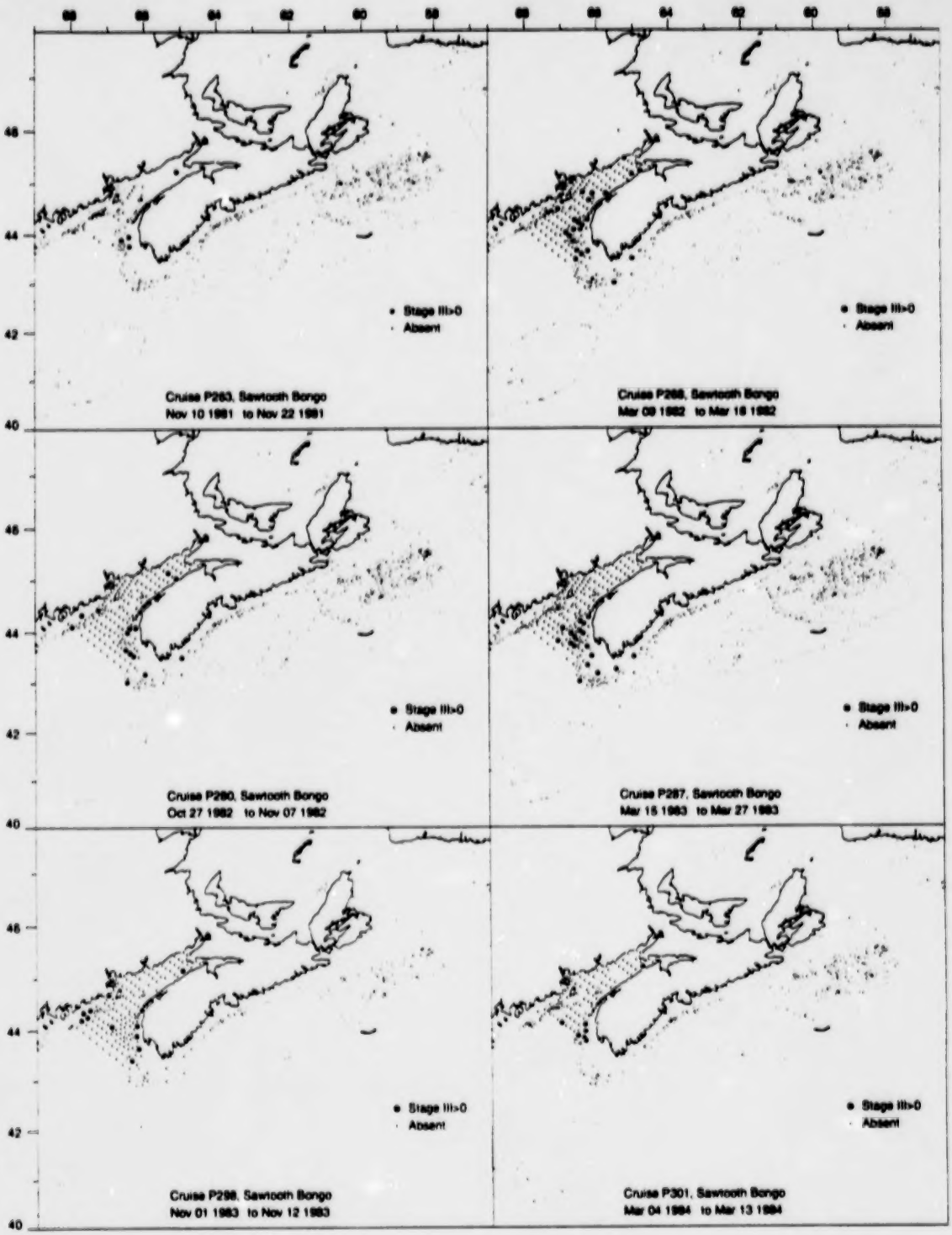

Stage III>0
Absent
Cruise P283, Sawtooth Bongo
Nov 10 1981 to Nov 22 1981
Cruise P288, Sawtooth Bongo
Mar 09 1982 to Mar 18 1982
Cruise P290, Sawtooth Bongo
Oct 27 1982 to Nov 07 1982
Cruise P297, Sawtooth Bongo
Mar 15 1983 to Mar 27 1983
Cruise P298, Sawtooth Bongo
Nov 01 1983 to Nov 12 1983
Cruise P301, Sawtooth Bongo
Mar 04 1984 to Mar 13 1984

Fig. 8.1.4. (continued).

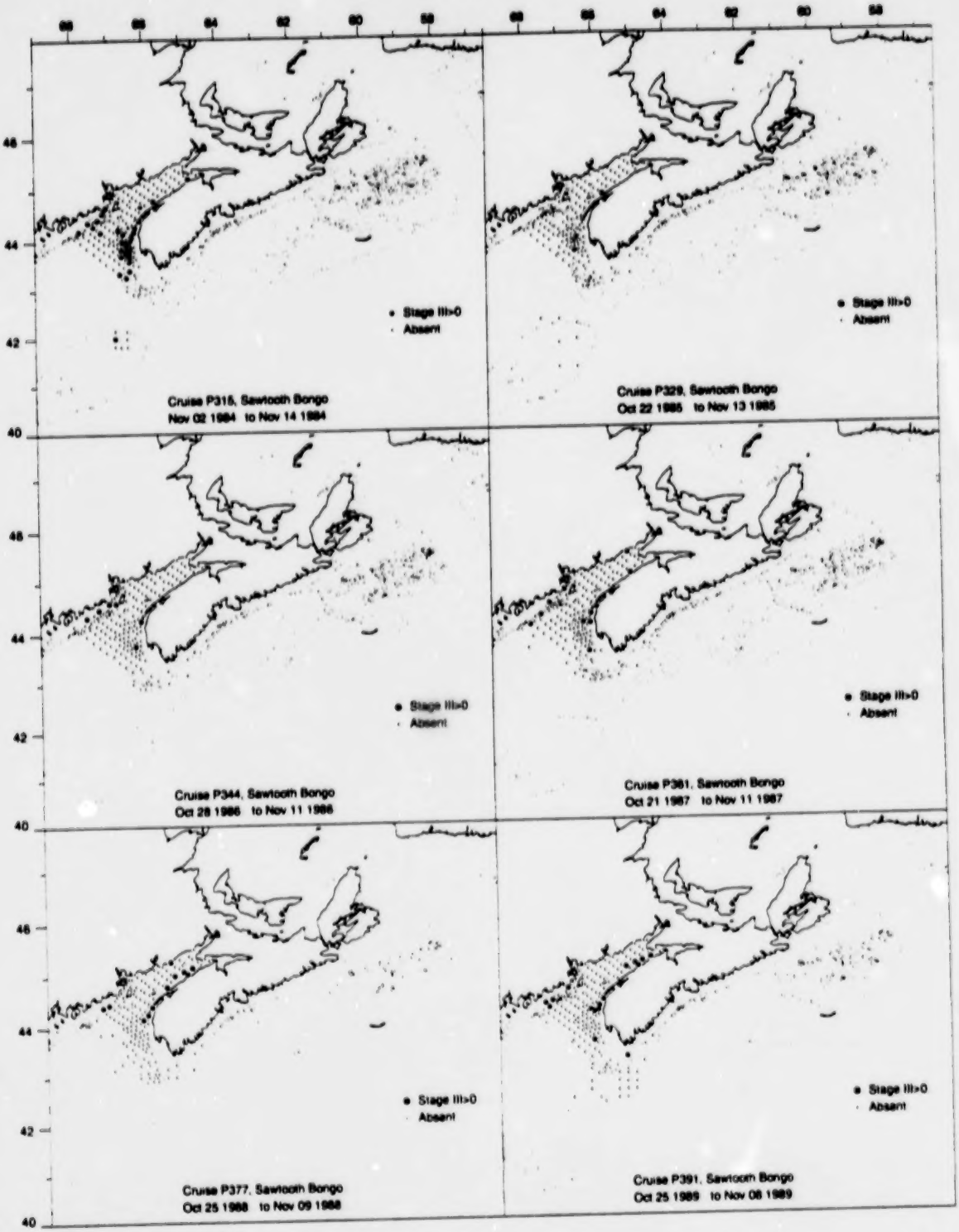

Stage III>0
Absent
Cruise P315, Sawtooth Bongo
Nov 02 1984 to Nov 14 1984
Cruise P329, Sawtooth Bongo
Oct 22 1985 to Nov 13 1985
Cruise P344, Sawtooth Bongo
Oct 28 1986 to Nov 11 1986
Cruise P361, Sawtooth Bongo
Oct 21 1987 to Nov 11 1987
Cruise P377, Sawtooth Bongo
Oct 25 1988 to Nov 09 1988
Cruise P391, Sawtooth Bongo
Oct 25 1989 to Nov 08 1989

Fig. 8.1.4. (continued).

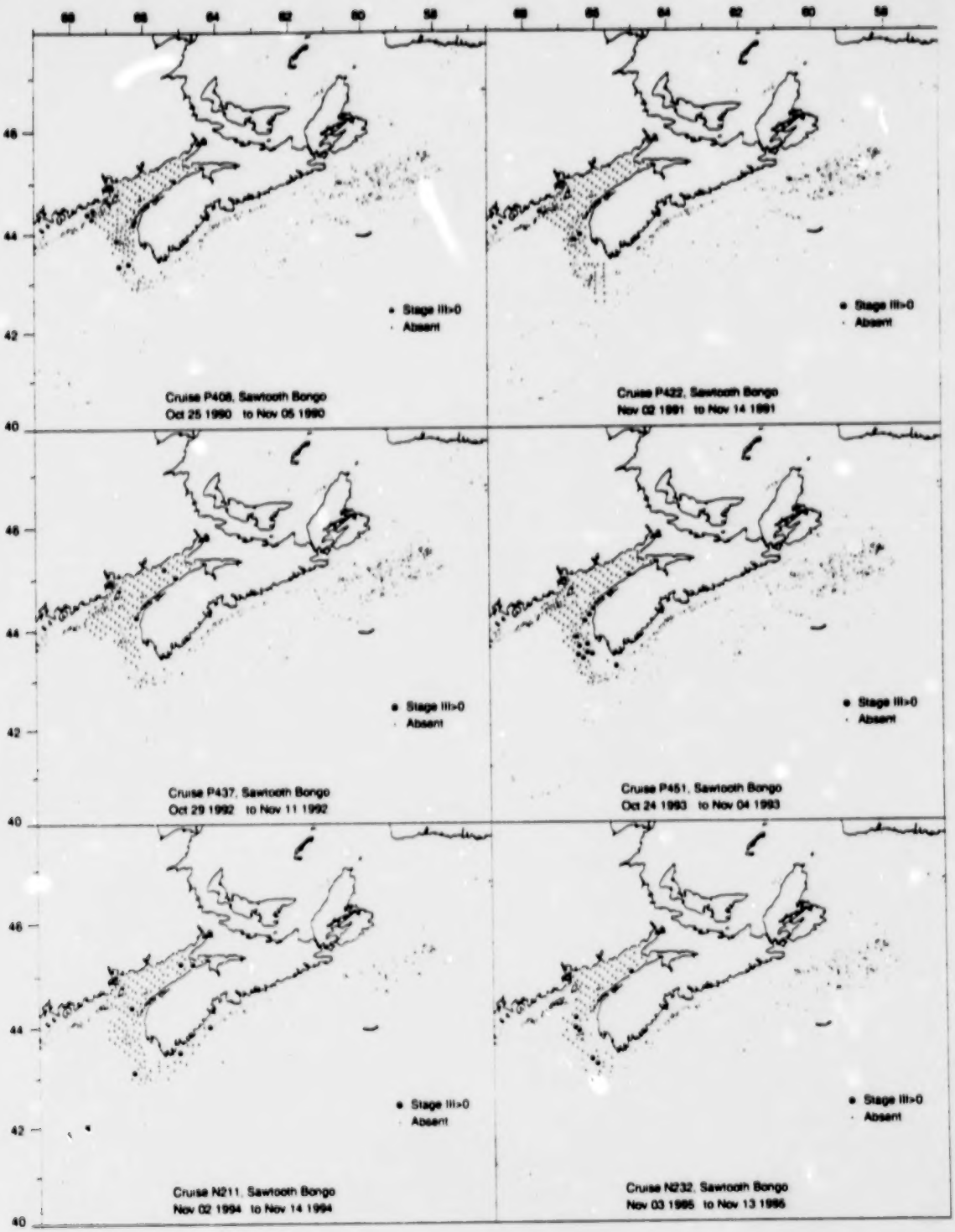

Stage III>0
Absent
Cruise P408, Sawtooth Bongo
Oct 25 1990 to Nov 05 1990
Cruise P422, Sawtooth Bongo
Nov 02 1991 to Nov 14 1991
Cruise P437, Sawtooth Bongo
Oct 29 1992 to Nov 11 1992
Cruise P451, Sawtooth Bongo
Oct 24 1993 to Nov 04 1993
Cruise N211, Sawtooth Bongo
Nov 02 1994 to Nov 14 1994
Cruise N232, Sawtooth Bongo
Nov 03 1995 to Nov 13 1995

Fig. 8.1.4. (continued).

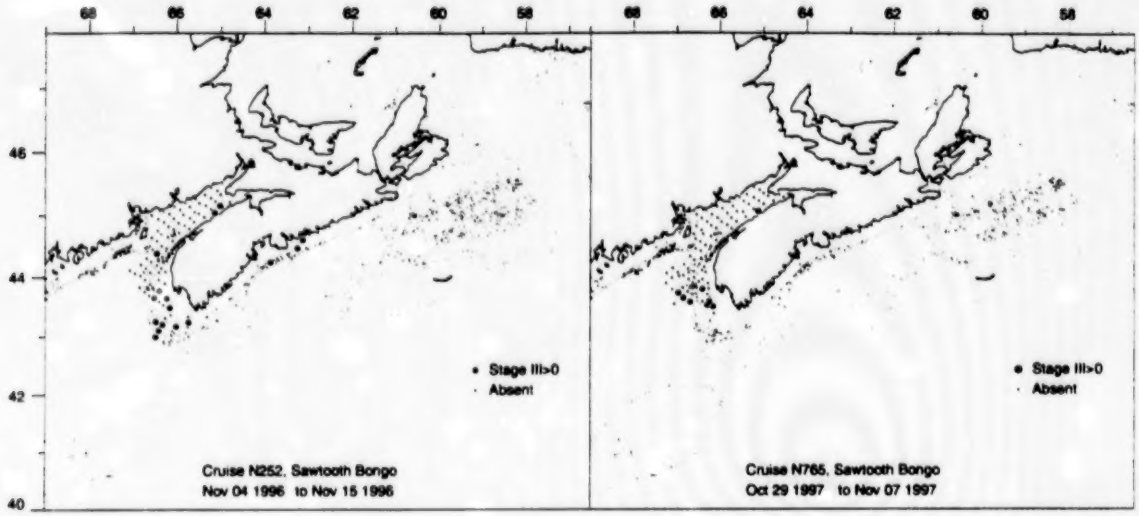


Fig. 8.1.4. (continued).

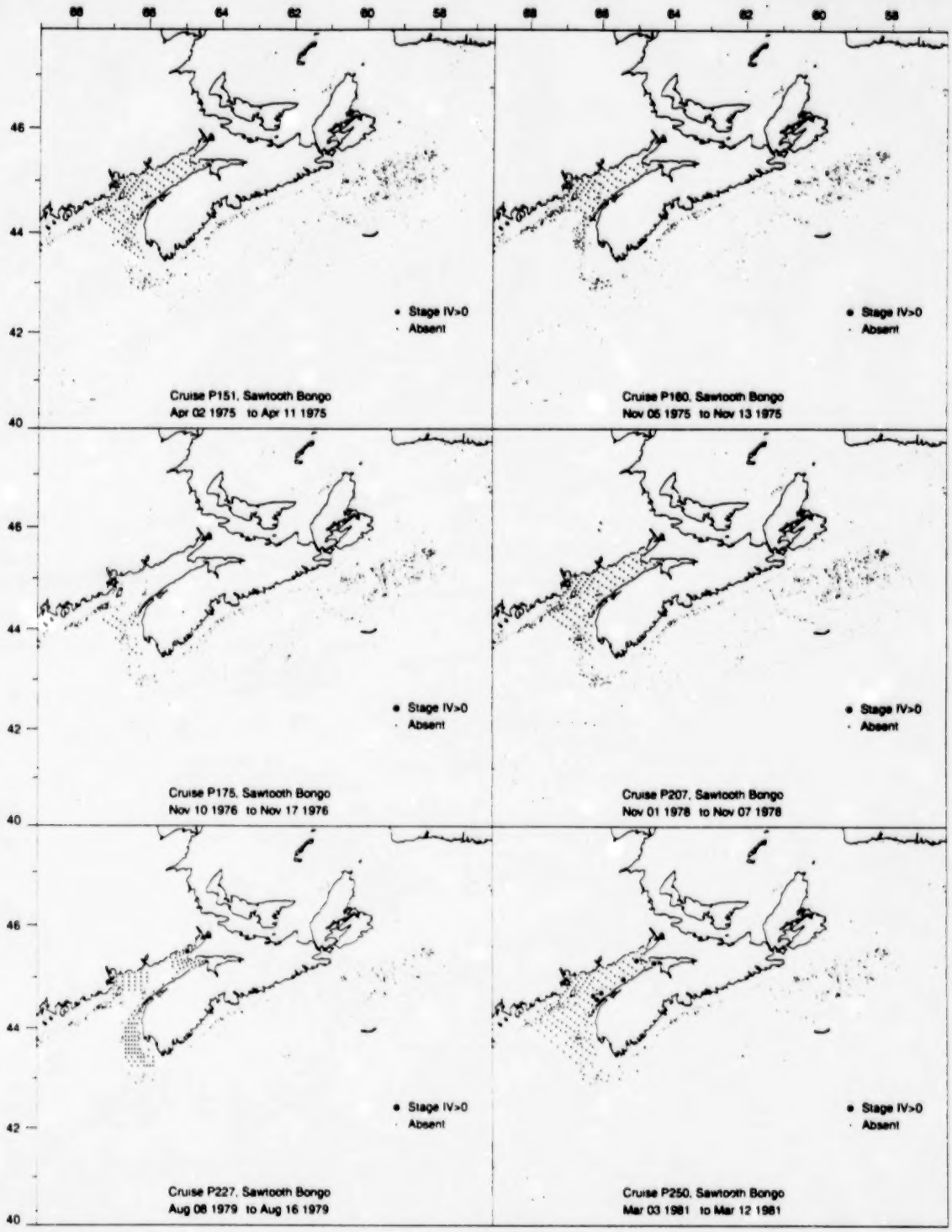

Stage IV>0
Absent
Cruise P151, Sawtooth Bongo
Apr 02 1975 to Apr 11 1975
Cruise P180, Sawtooth Bongo
Nov 05 1975 to Nov 13 1975
Cruise P175, Sawtooth Bongo
Nov 10 1976 to Nov 17 1976
Cruise P207, Sawtooth Bongo
Nov 01 1978 to Nov 07 1978
Cruise P227, Sawtooth Bongo
Aug 08 1979 to Aug 16 1979
Cruise P250, Sawtooth Bongo
Mar 03 1981 to Mar 12 1981

Fig. 8.1.5. Larval Herring Program-Bay of Fundy Cruises: Stage IV cod eggs.

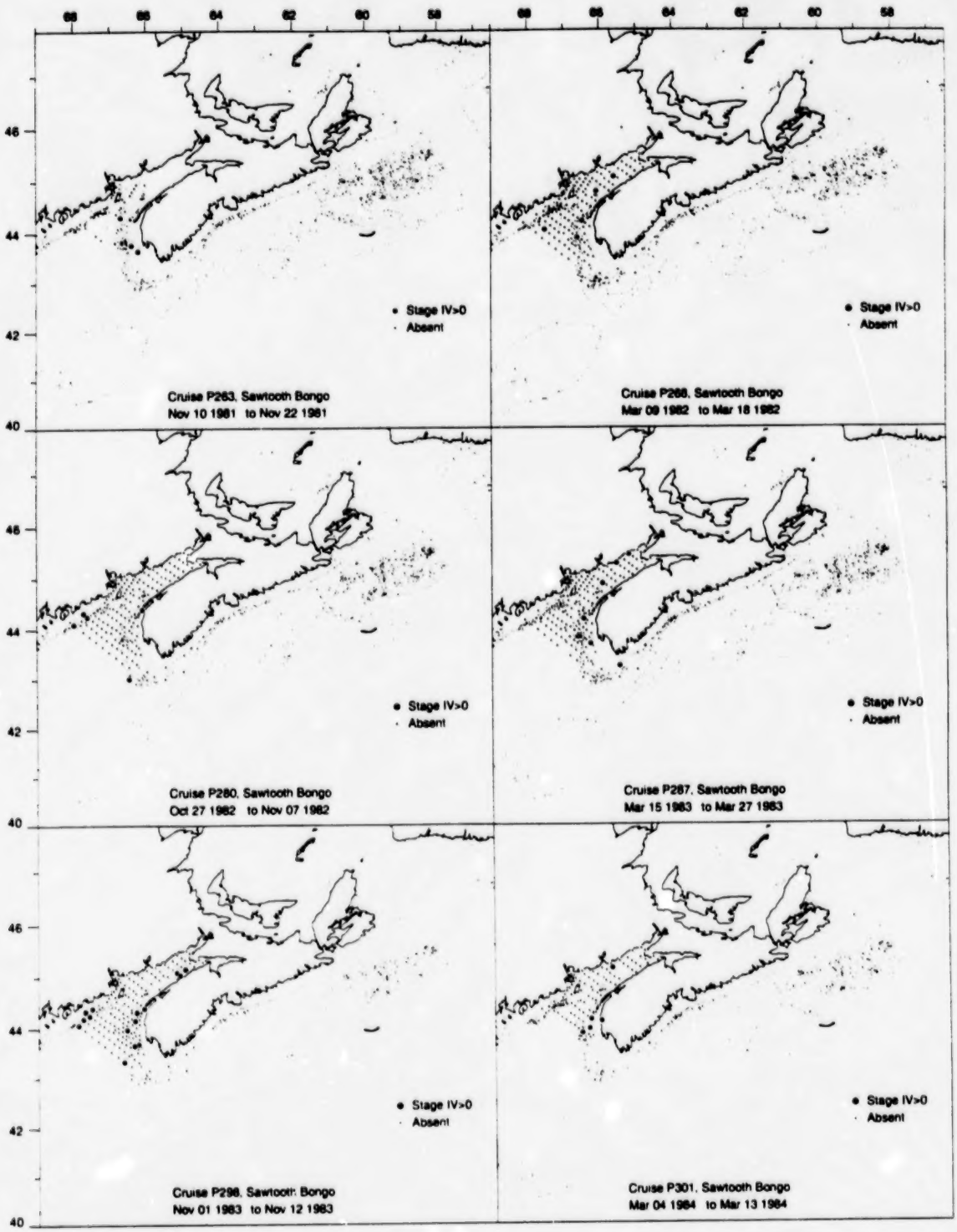


Fig. 8.1.5. (continued).

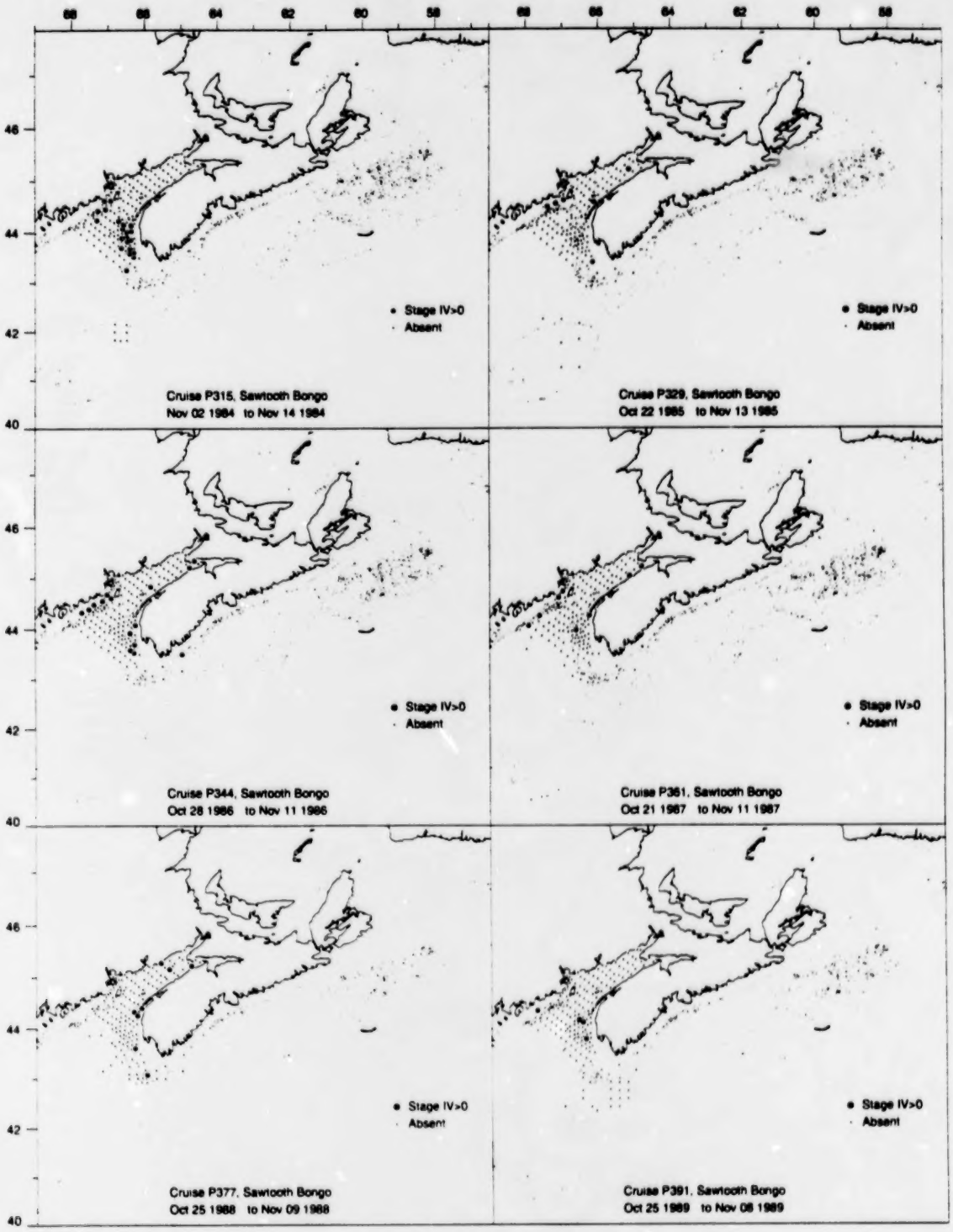

Stage IV>0
Absent
Cruise P315, Sawtooth Bongo
Nov 02 1984 to Nov 14 1984
Cruise P329, Sawtooth Bongo
Oct 22 1985 to Nov 13 1985
Cruise P344, Sawtooth Bongo
Oct 28 1986 to Nov 11 1986
Cruise P361, Sawtooth Bongo
Oct 21 1987 to Nov 11 1987
Cruise P377, Sawtooth Bongo
Oct 25 1988 to Nov 09 1988
Cruise P391, Sawtooth Bongo
Oct 25 1989 to Nov 08 1989

Fig. 8.1.5. (continued).

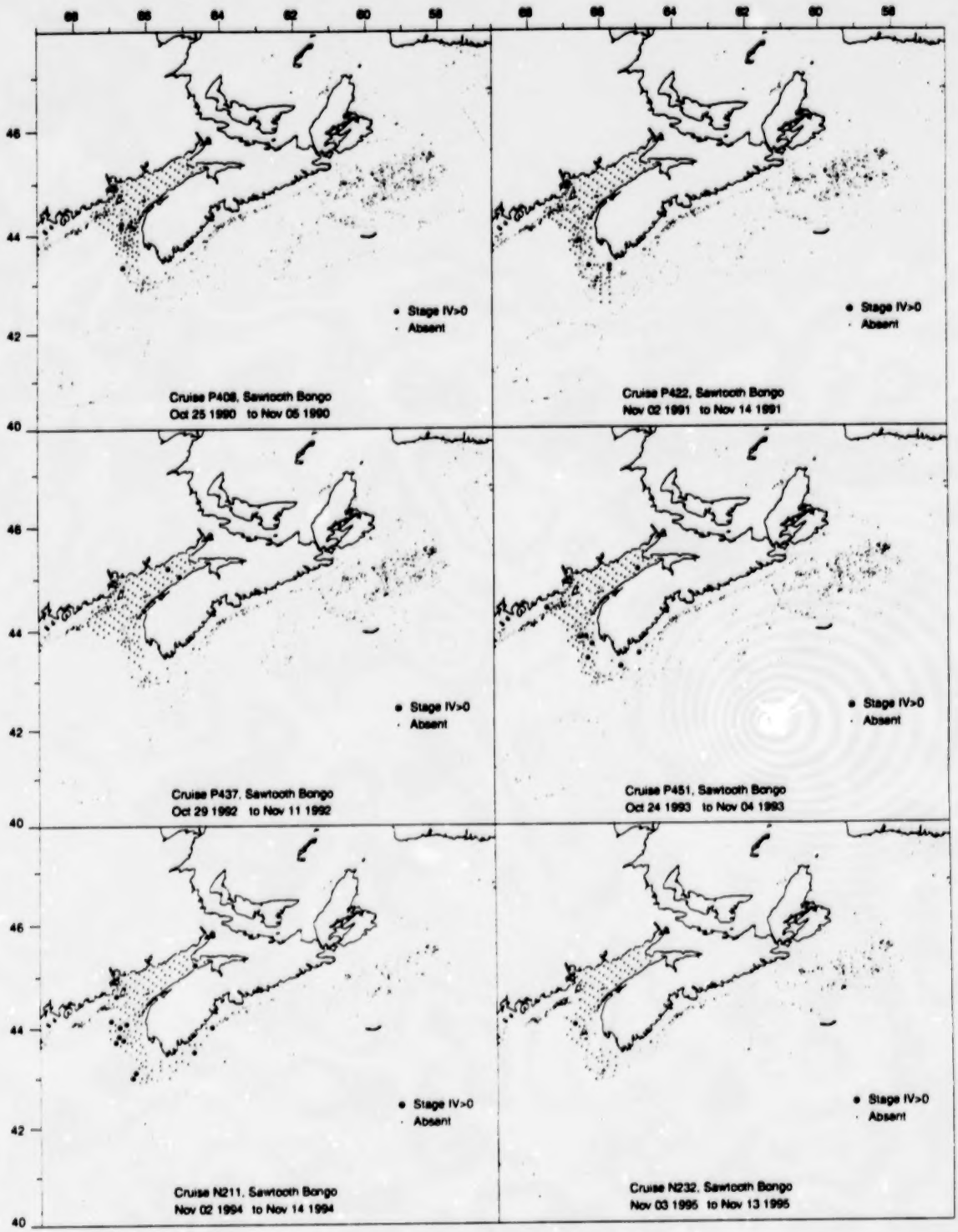

Stage IV>0
Absent
Cruise P408, Sawtooth Bongo
Oct 25 1990 to Nov 05 1990
Cruise P422, Sawtooth Bongo
Nov 02 1991 to Nov 14 1991
Cruise P437, Sawtooth Bongo
Oct 29 1992 to Nov 11 1992
Cruise P451, Sawtooth Bongo
Oct 24 1993 to Nov 04 1993
Cruise N211, Sawtooth Bongo
Nov 02 1994 to Nov 14 1994
Cruise N232, Sawtooth Bongo
Nov 03 1995 to Nov 13 1995

Fig. 8.1.5. (continued).

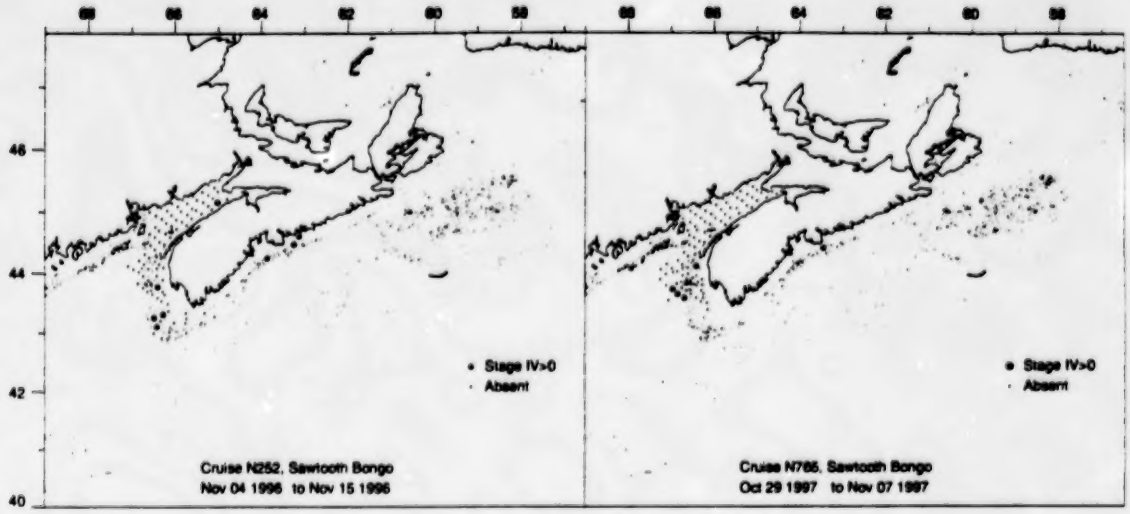


Fig. 8.1.5. (continued).

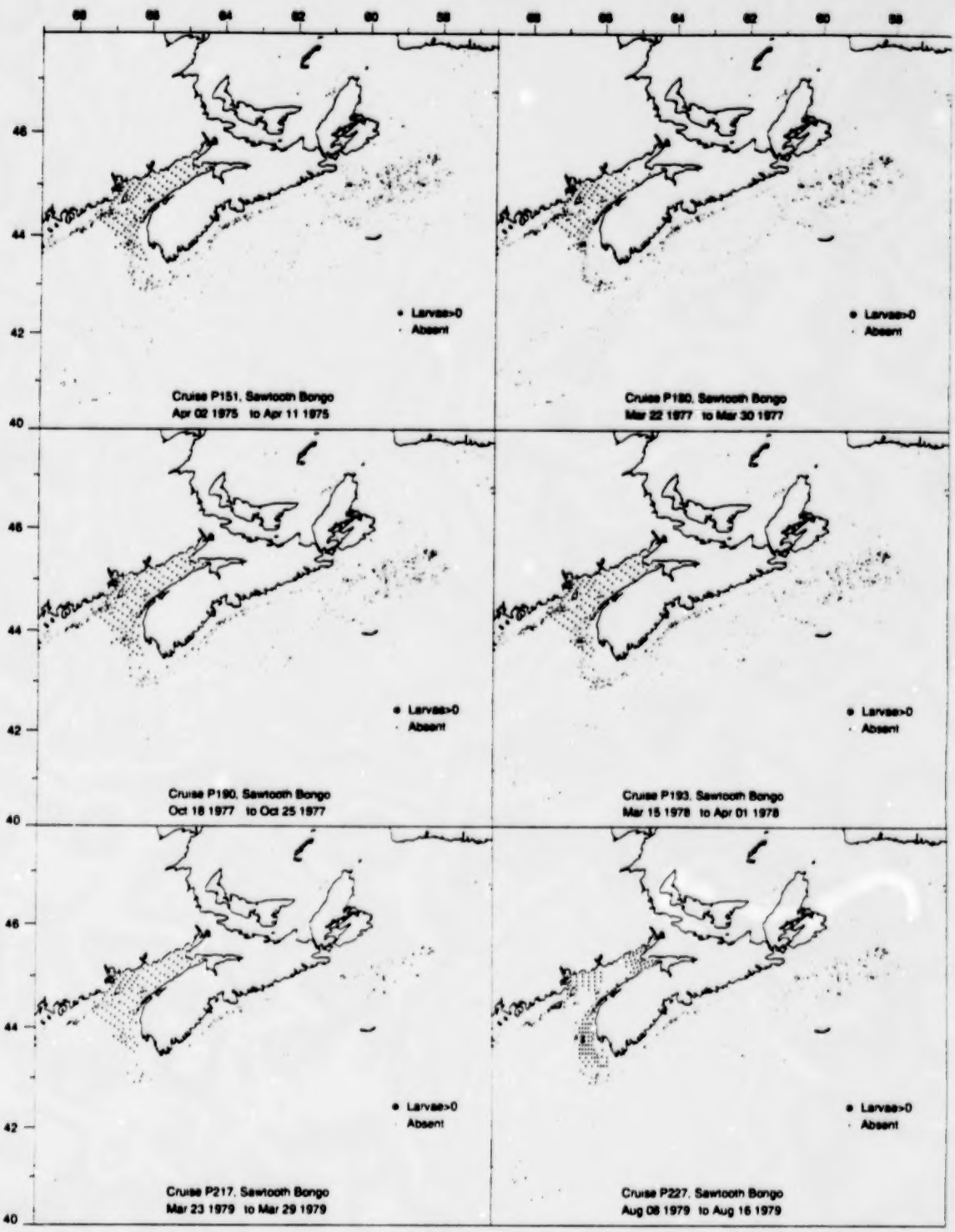

Larvae>0
Absent
Cruise P151, Sawtooth Bongo
Apr 02 1975 to Apr 11 1975
Cruise P180, Sawtooth Bongo
Mar 22 1977 to Mar 30 1977
Cruise P190, Sawtooth Bongo
Oct 18 1977 to Oct 25 1977
Cruise P193, Sawtooth Bongo
Mar 15 1978 to Apr 01 1978
Cruise P217, Sawtooth Bongo
Mar 23 1979 to Mar 29 1979
Cruise P227, Sawtooth Bongo
Aug 08 1979 to Aug 16 1979

Fig. 8.1.6. Larval Herring Program-Bay of Fundy Cruises: Cod larvae (1-7mm).

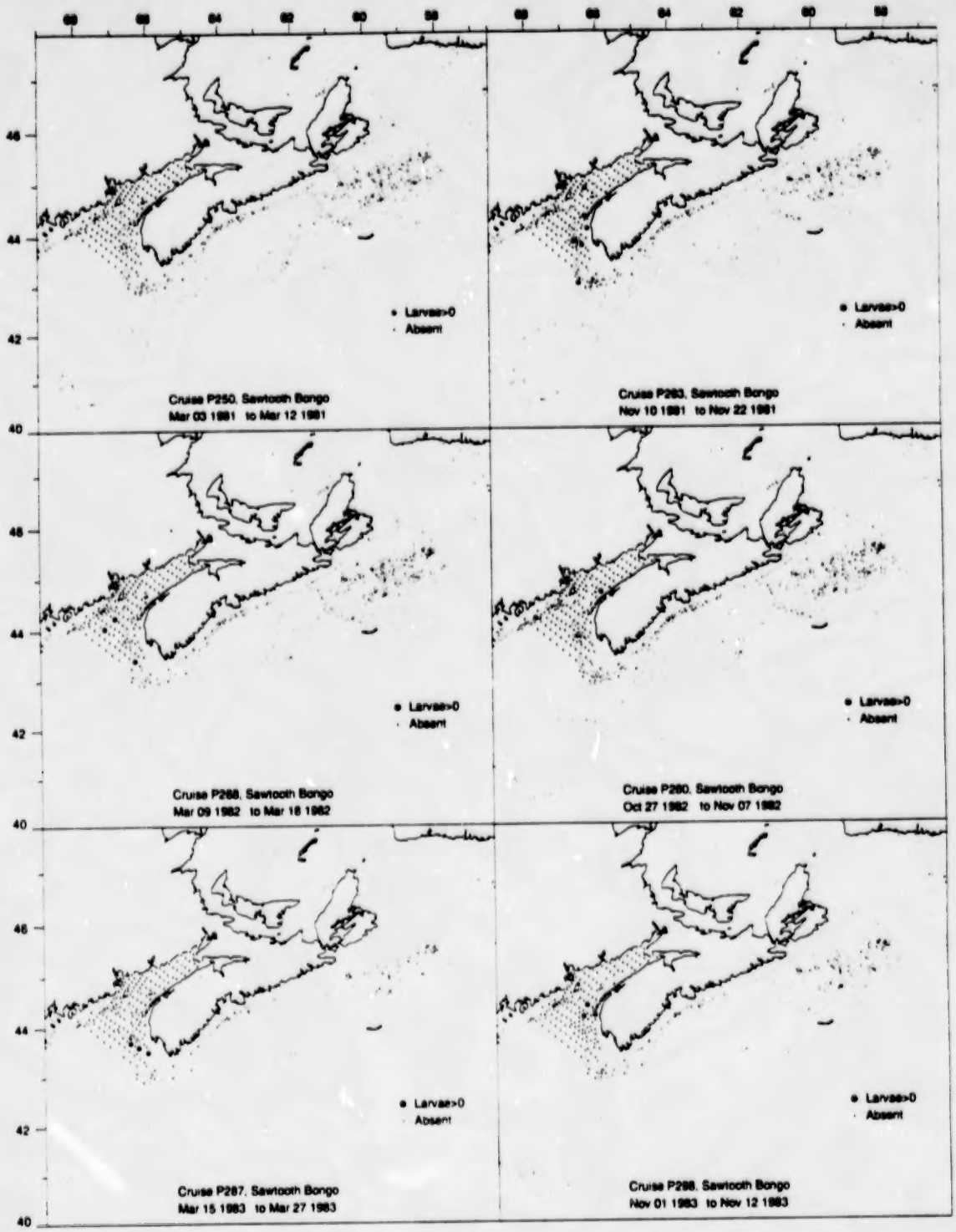

Larvae>0
Absent
Cruise P250. Sawtooth Bongo
Mar 03 1981 to Mar 12 1981
Cruise P263. Sawtooth Bongo
Nov 10 1981 to Nov 22 1981
Cruise P268. Sawtooth Bongo
Mar 09 1982 to Mar 18 1982
Cruise P280. Sawtooth Bongo
Oct 27 1982 to Nov 07 1982
Cruise P287. Sawtooth Bongo
Mar 15 1983 to Mar 27 1983
Cruise P298. Sawtooth Bongo
Nov 01 1983 to Nov 12 1983

Fig. 8.1.6. (continued).

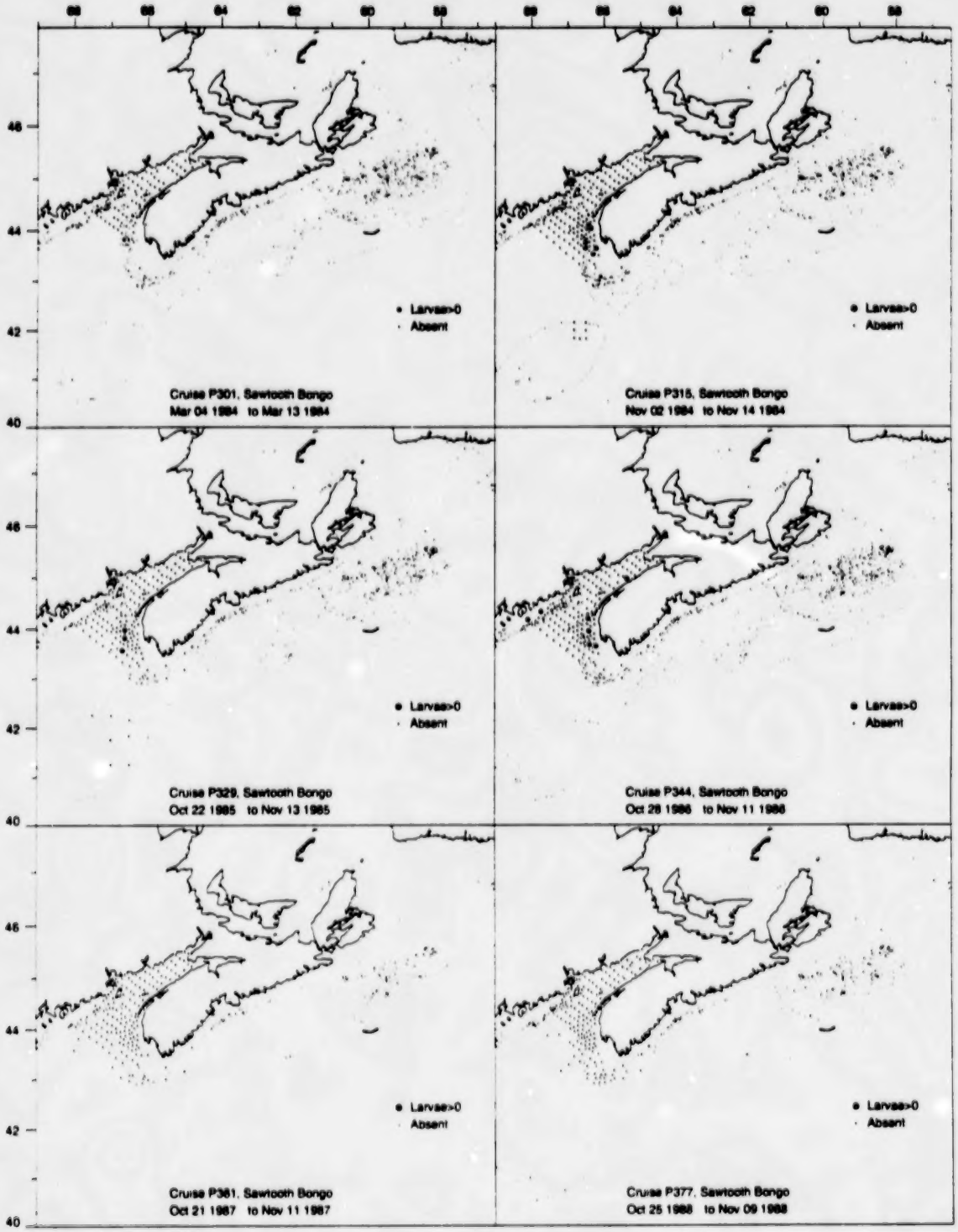

Larvae>0
Absent
Cruise P301, Sawtooth Bongo
Mar 04 1984 to Mar 13 1984
Cruise P315, Sawtooth Bongo
Nov 02 1984 to Nov 14 1984
Cruise P329, Sawtooth Bongo
Oct 22 1985 to Nov 13 1985
Cruise P344, Sawtooth Bongo
Oct 28 1986 to Nov 11 1986
Cruise P361, Sawtooth Bongo
Oct 21 1987 to Nov 11 1987
Cruise P377, Sawtooth Bongo
Oct 25 1988 to Nov 09 1988

Fig. 8.1.6. (continued).

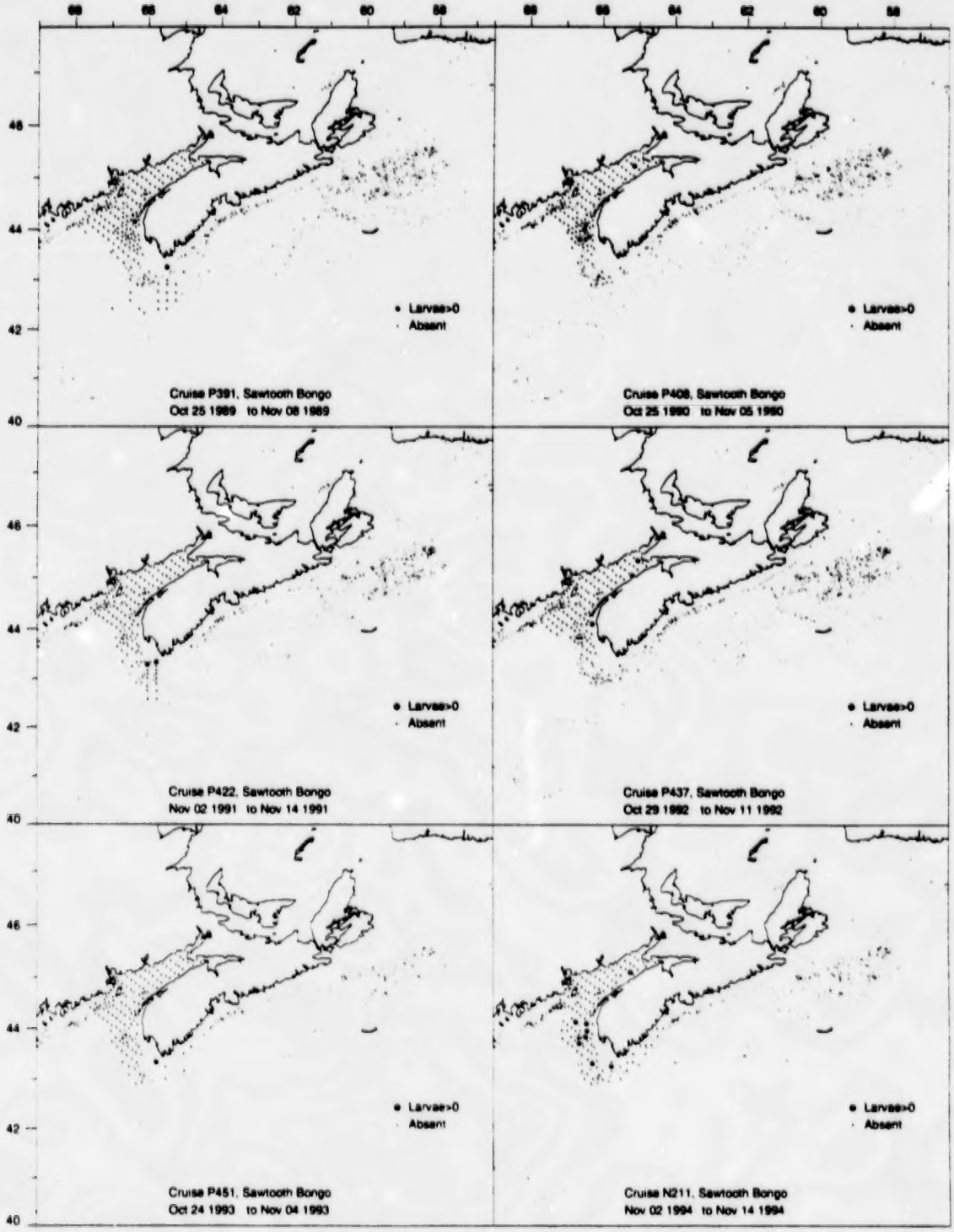
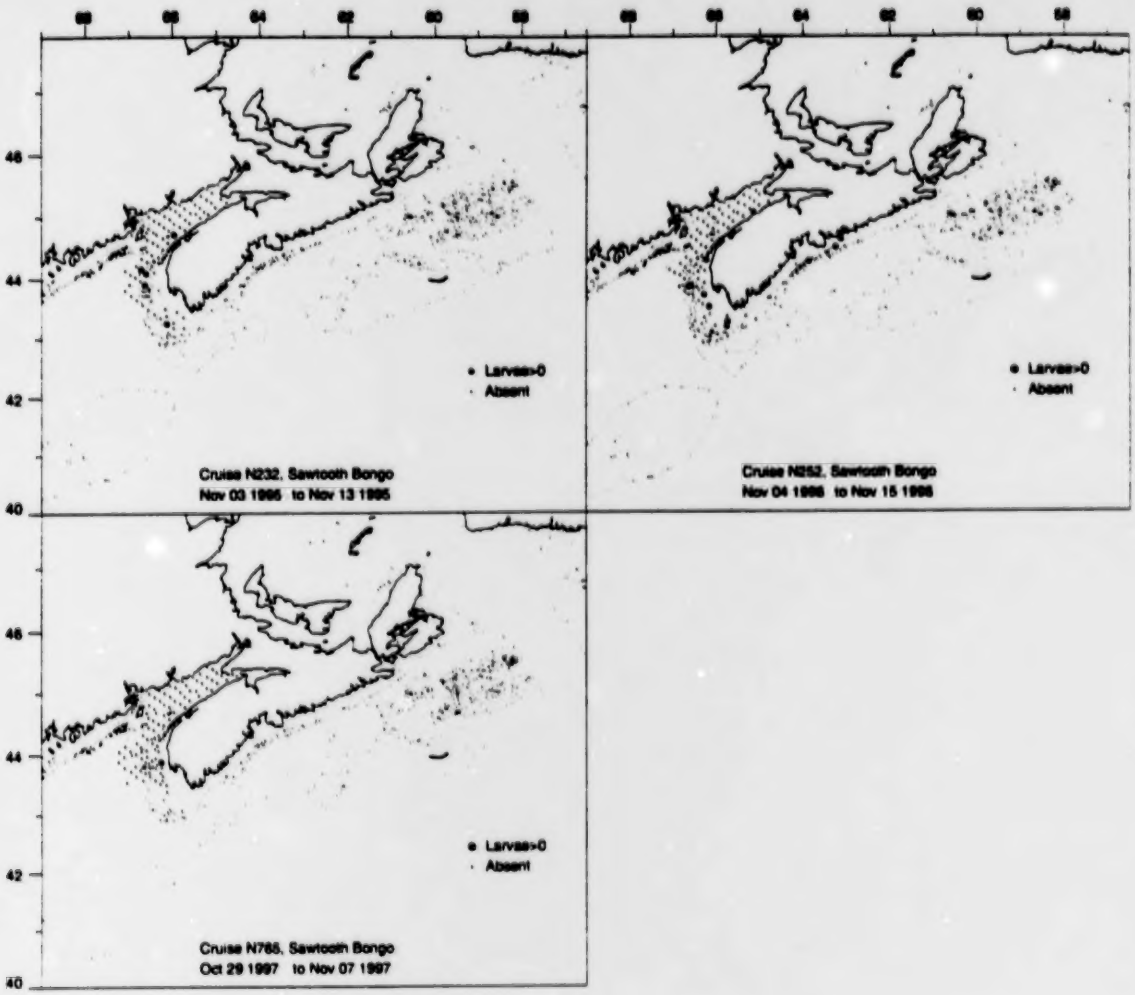


Fig. 8.1.6. (continued).



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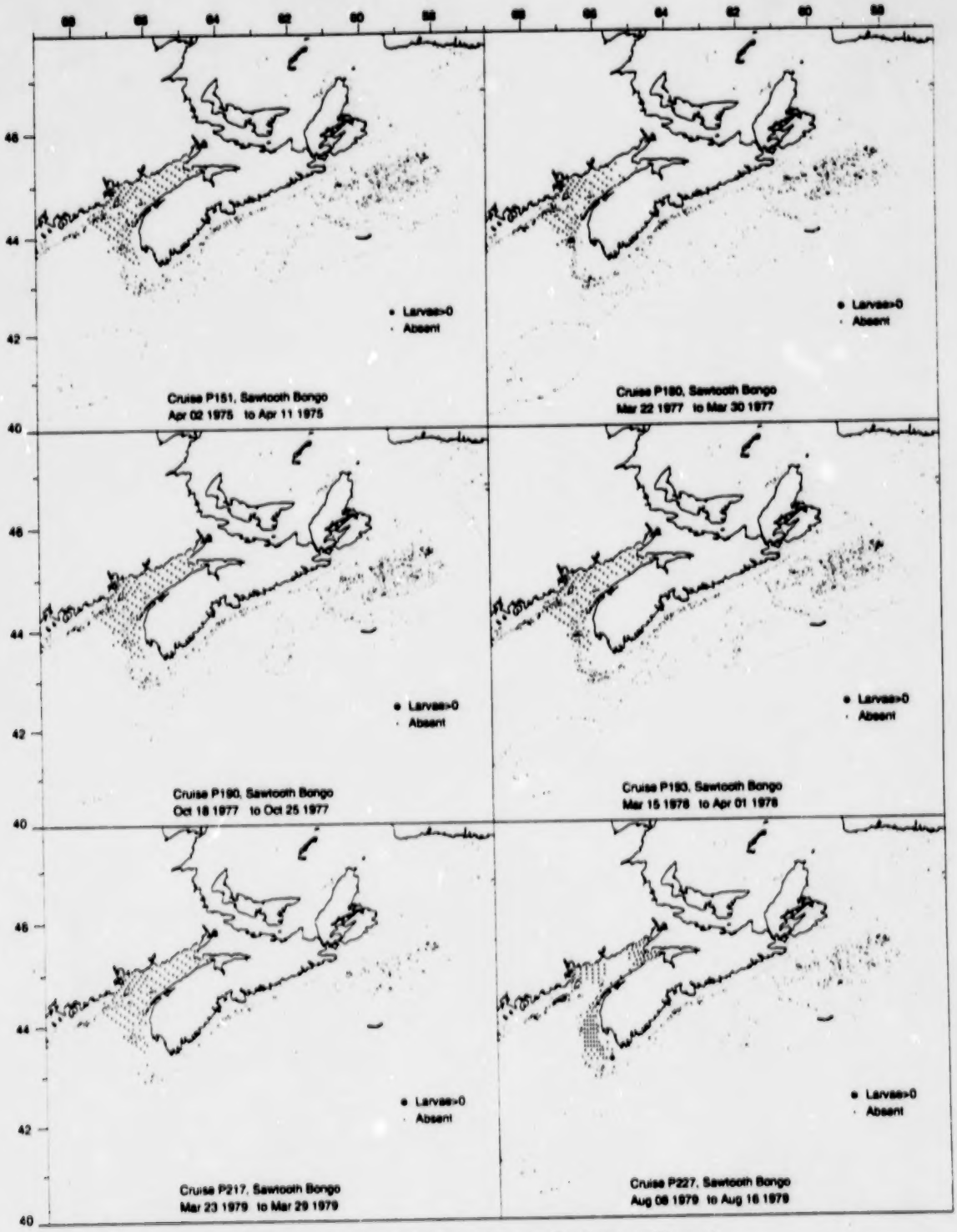

Cruise P151, Sawtooth Bongo
Apr 02 1975 to Apr 11 1975
Cruise P180, Sawtooth Bongo
Mar 22 1977 to Mar 30 1977
Cruise P190, Sawtooth Bongo
Oct 18 1977 to Oct 25 1977
Cruise P193, Sawtooth Bongo
Mar 15 1978 to Apr 01 1978
Cruise P217, Sawtooth Bongo
Mar 23 1979 to Mar 29 1979
Cruise P227, Sawtooth Bongo
Aug 08 1979 to Aug 16 1979
Larvae>0
Absent

Fig. 8.1.7. Larval Herring Program-Bay of Fundy Cruises: Cod larvae (7+mm).

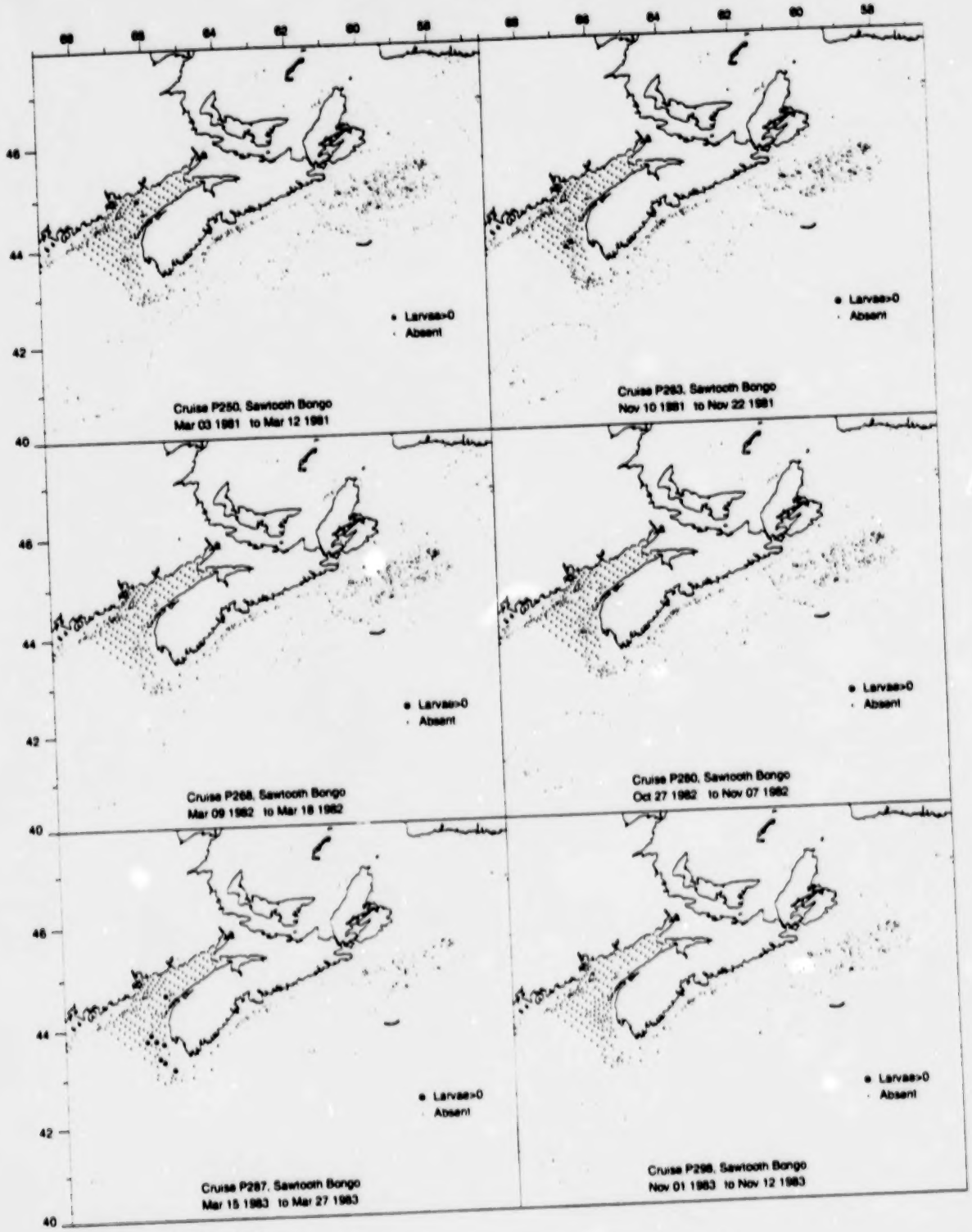

Cruise P250. Sawtooth Bongo
Mar 03 1981 to Mar 12 1981
Cruise P263. Sawtooth Bongo
Nov 10 1981 to Nov 22 1981
Cruise P268. Sawtooth Bongo
Mar 09 1982 to Mar 18 1982
Cruise P280. Sawtooth Bongo
Oct 27 1982 to Nov 07 1982
Cruise P287. Sawtooth Bongo
Mar 15 1983 to Mar 27 1983
Cruise P298. Sawtooth Bongo
Nov 01 1983 to Nov 12 1983
Larvae>0
Absent

Fig. 8.1.7. (continued).

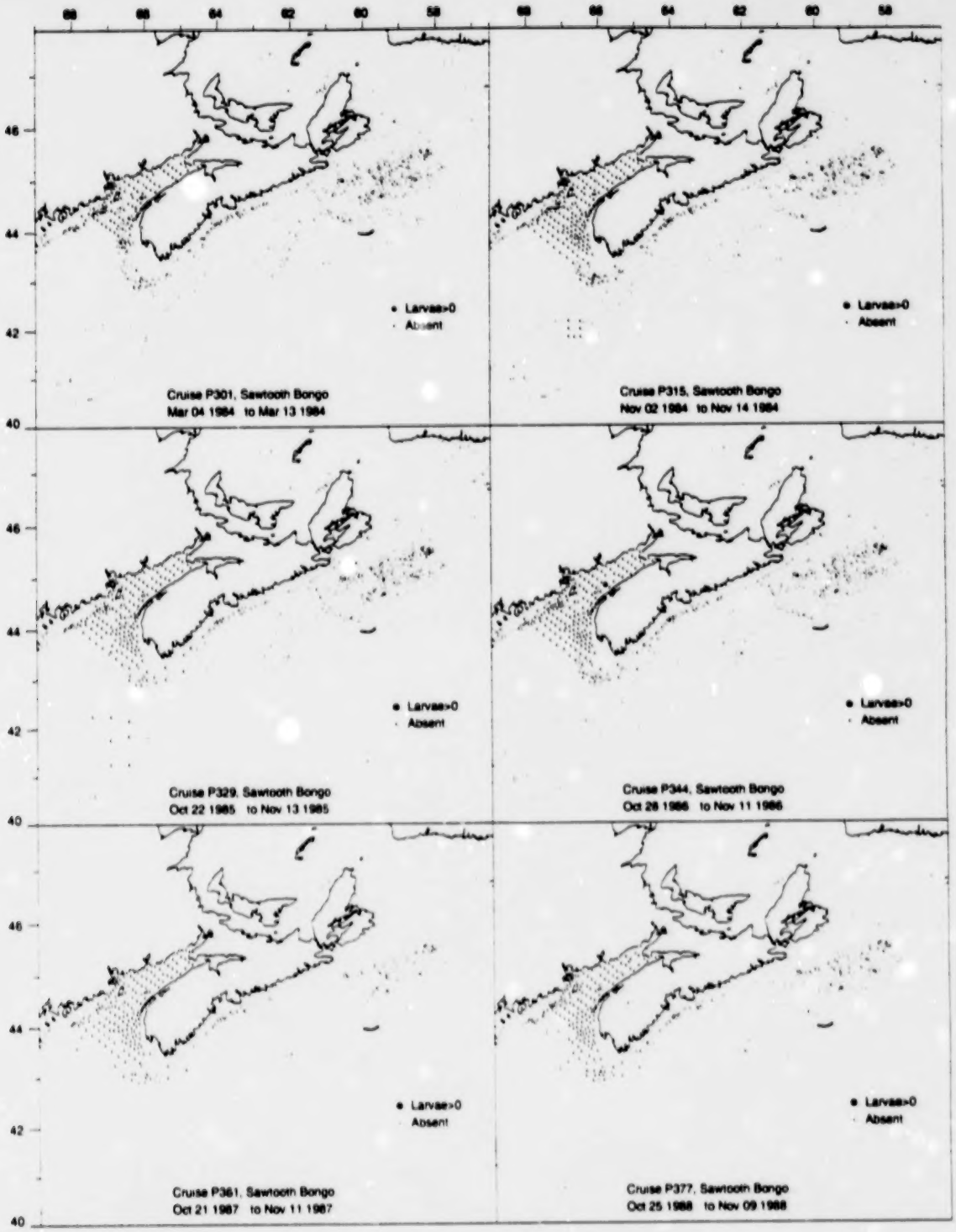

Larvae>0
Absent
Cruise P301, Sawtooth Bongo
Mar 04 1984 to Mar 13 1984
Cruise P315, Sawtooth Bongo
Nov 02 1984 to Nov 14 1984
Cruise P329, Sawtooth Bongo
Oct 22 1985 to Nov 13 1985
Cruise P344, Sawtooth Bongo
Oct 28 1986 to Nov 11 1986
Cruise P361, Sawtooth Bongo
Oct 21 1987 to Nov 11 1987
Cruise P377, Sawtooth Bongo
Oct 25 1988 to Nov 09 1988

Fig. 8.1.7. (continued).

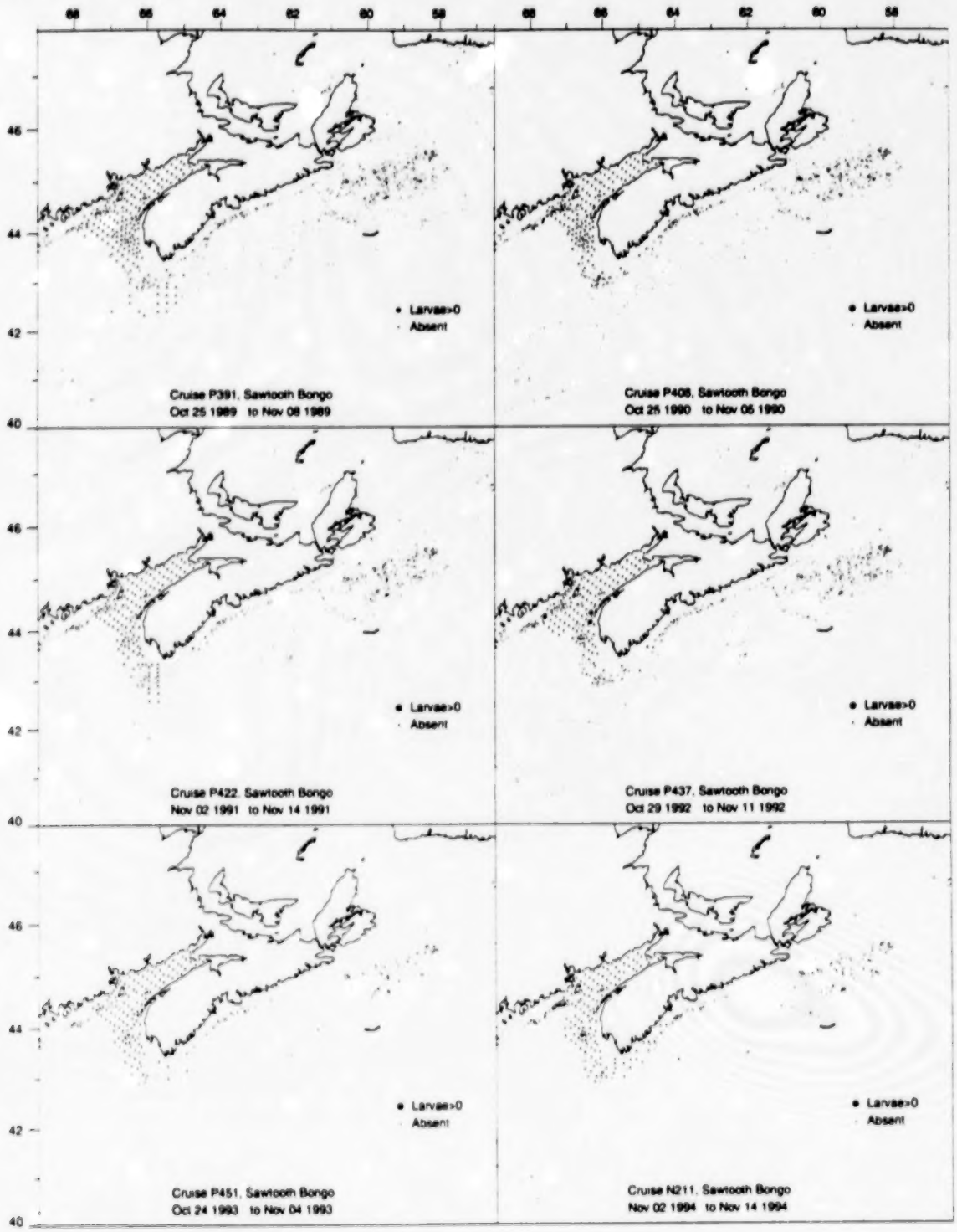


Fig. 8.1.7. (continued).

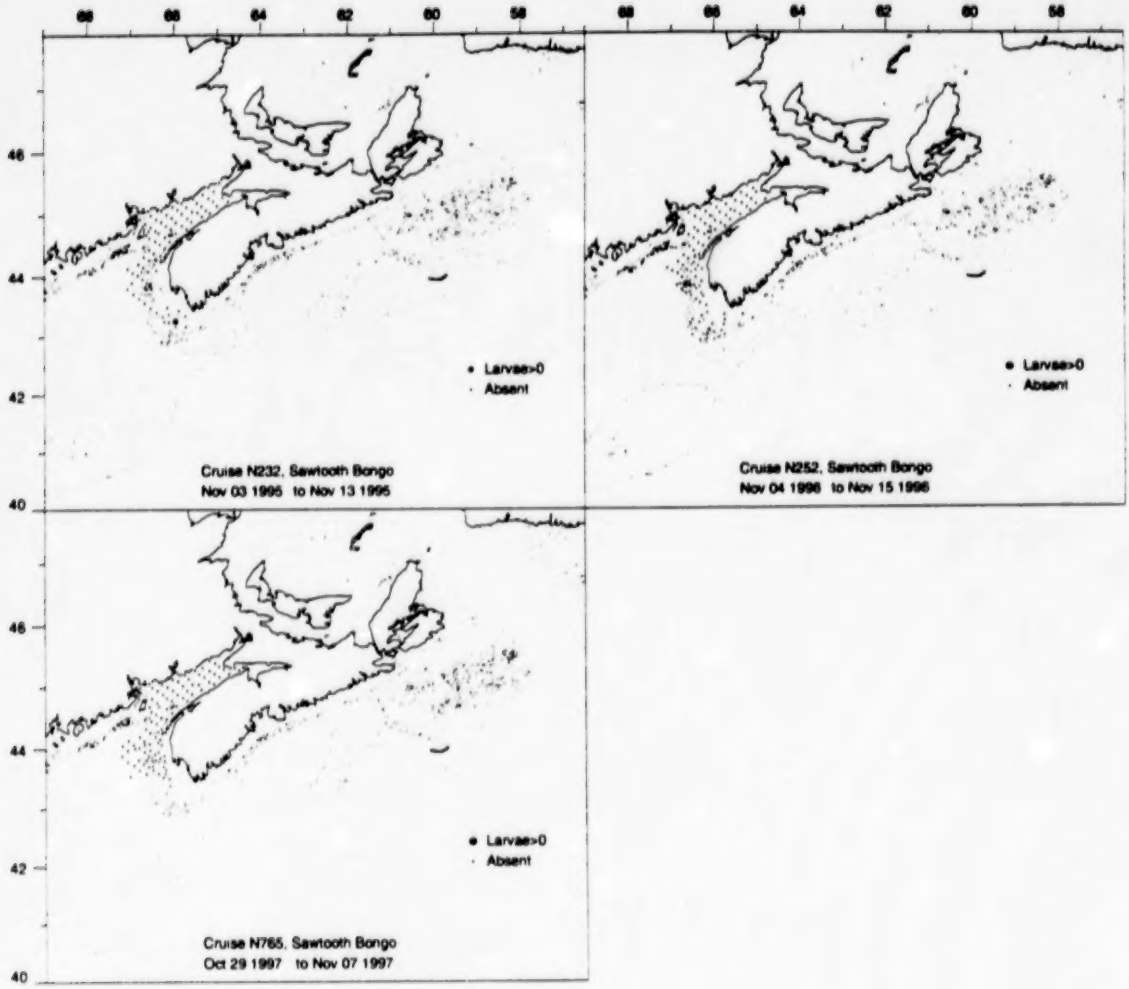


Fig. 8.1.7. (continued).

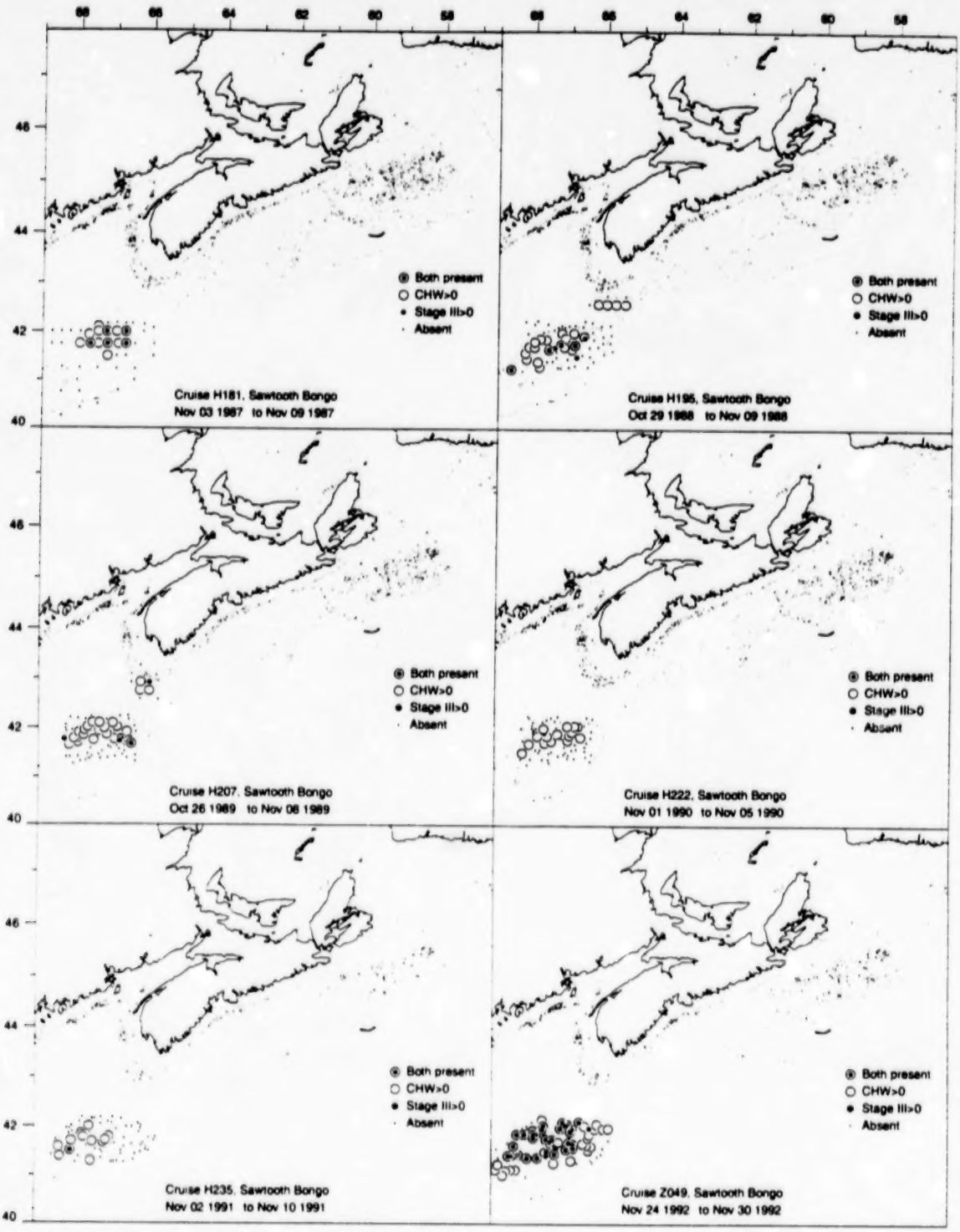

Both present
CHW>0
Stage III>0
Absent
Cruise H181, Sawtooth Bongo
Nov 03 1987 to Nov 09 1987
Cruise H195, Sawtooth Bongo
Oct 29 1988 to Nov 09 1988
Cruise H207, Sawtooth Bongo
Oct 26 1989 to Nov 08 1989
Cruise H222, Sawtooth Bongo
Nov 01 1990 to Nov 05 1990
Cruise H235, Sawtooth Bongo
Nov 02 1991 to Nov 10 1991
Cruise Z049, Sawtooth Bongo
Nov 24 1992 to Nov 30 1992

Fig. 8.2.1. Larval Herring Program-Georges Bank Cruises: Stage I CHW and Stage III cod eggs.

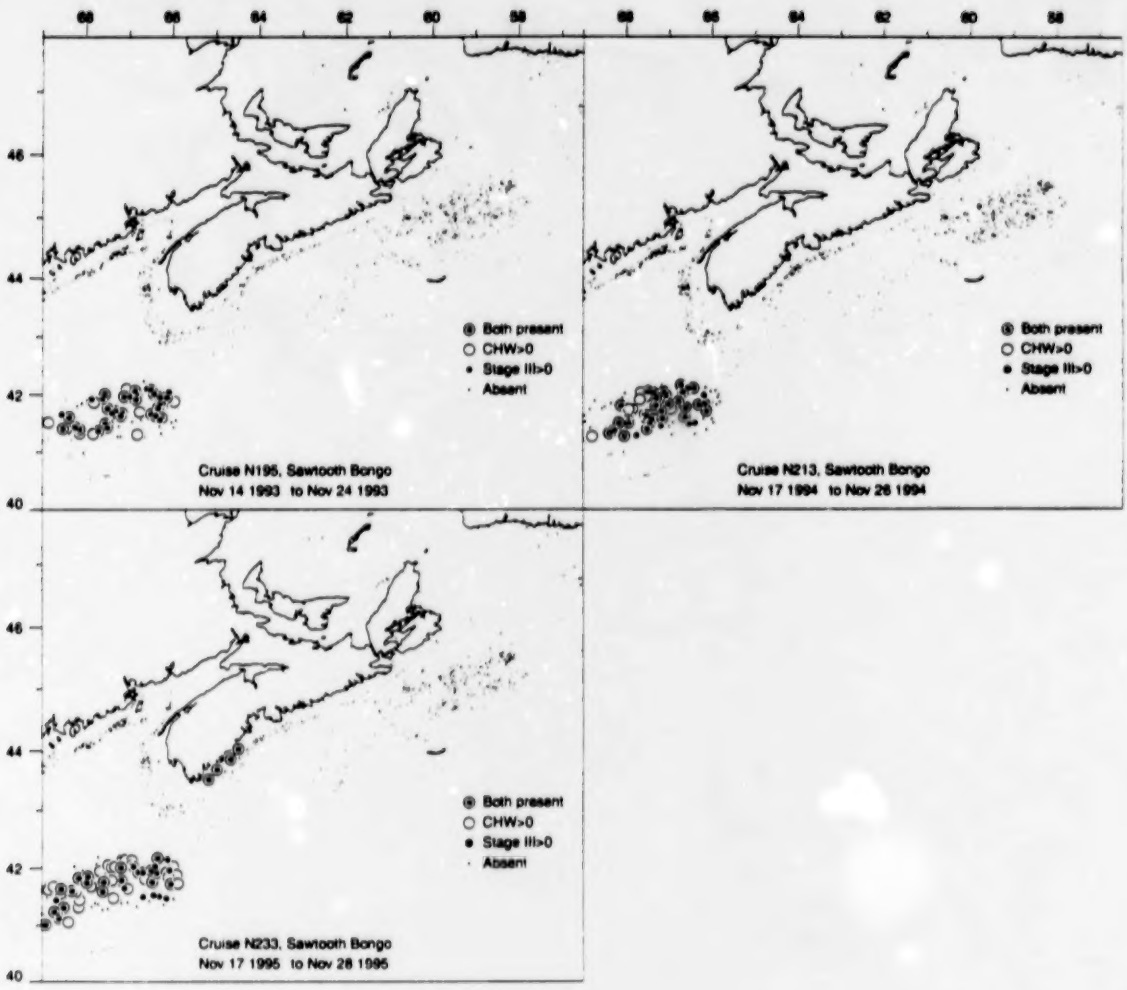


Fig. 8.2.1. (continued).

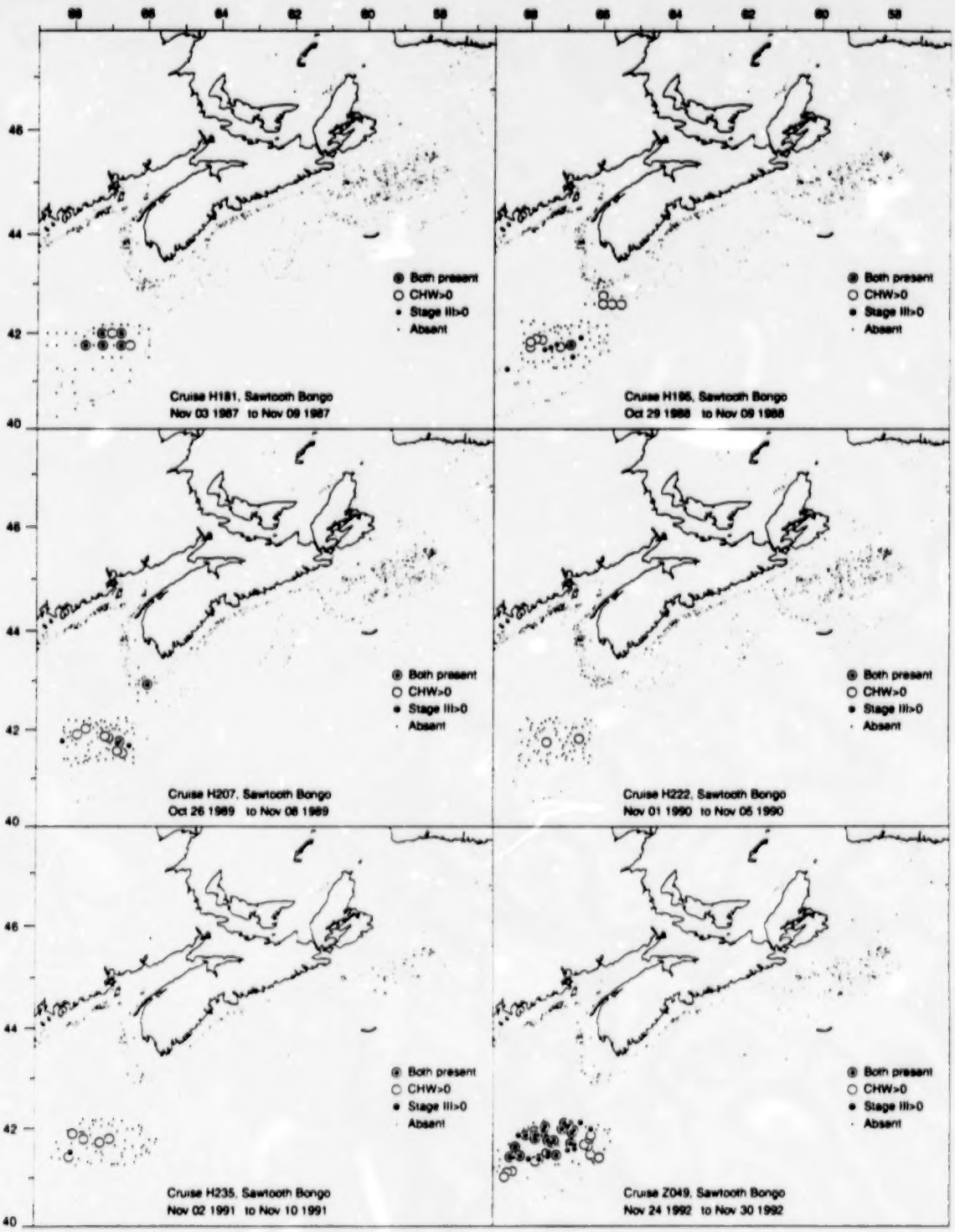

Both present
CHW>0
Stage III>0
Absent
Cruise H181, Sawtooth Bongo
Nov 03 1987 to Nov 09 1987
Cruise H195, Sawtooth Bongo
Oct 29 1988 to Nov 09 1988
Cruise H207, Sawtooth Bongo
Oct 26 1989 to Nov 08 1989
Cruise H222, Sawtooth Bongo
Nov 01 1990 to Nov 05 1990
Cruise H235, Sawtooth Bongo
Nov 02 1991 to Nov 10 1991
Cruise Z049, Sawtooth Bongo
Nov 24 1992 to Nov 30 1992

Fig. 8.2.2. Larval Herring Program-Georges Bank Cruises: Stage II CHW and Stage III cod eggs.

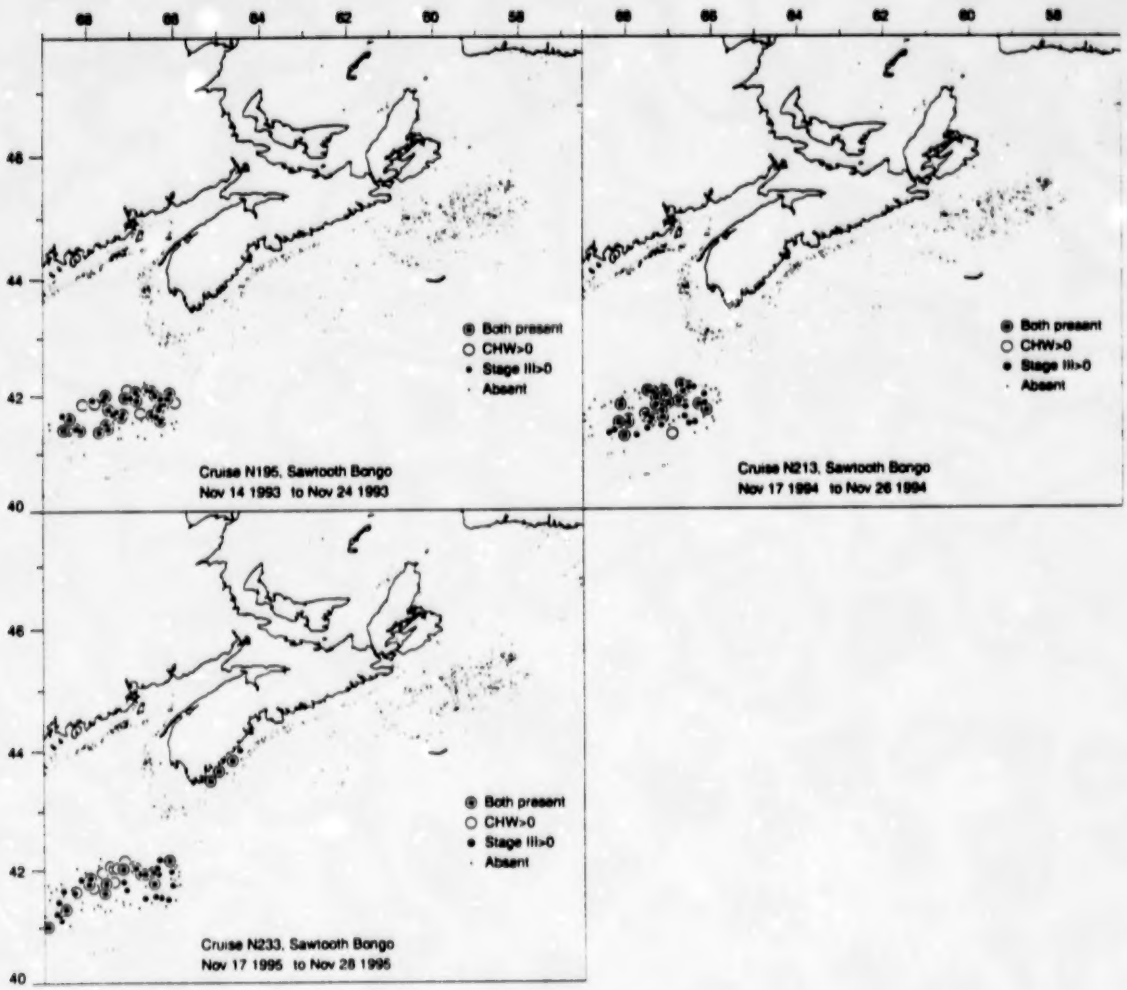


Fig. 8.2.2. (continued).

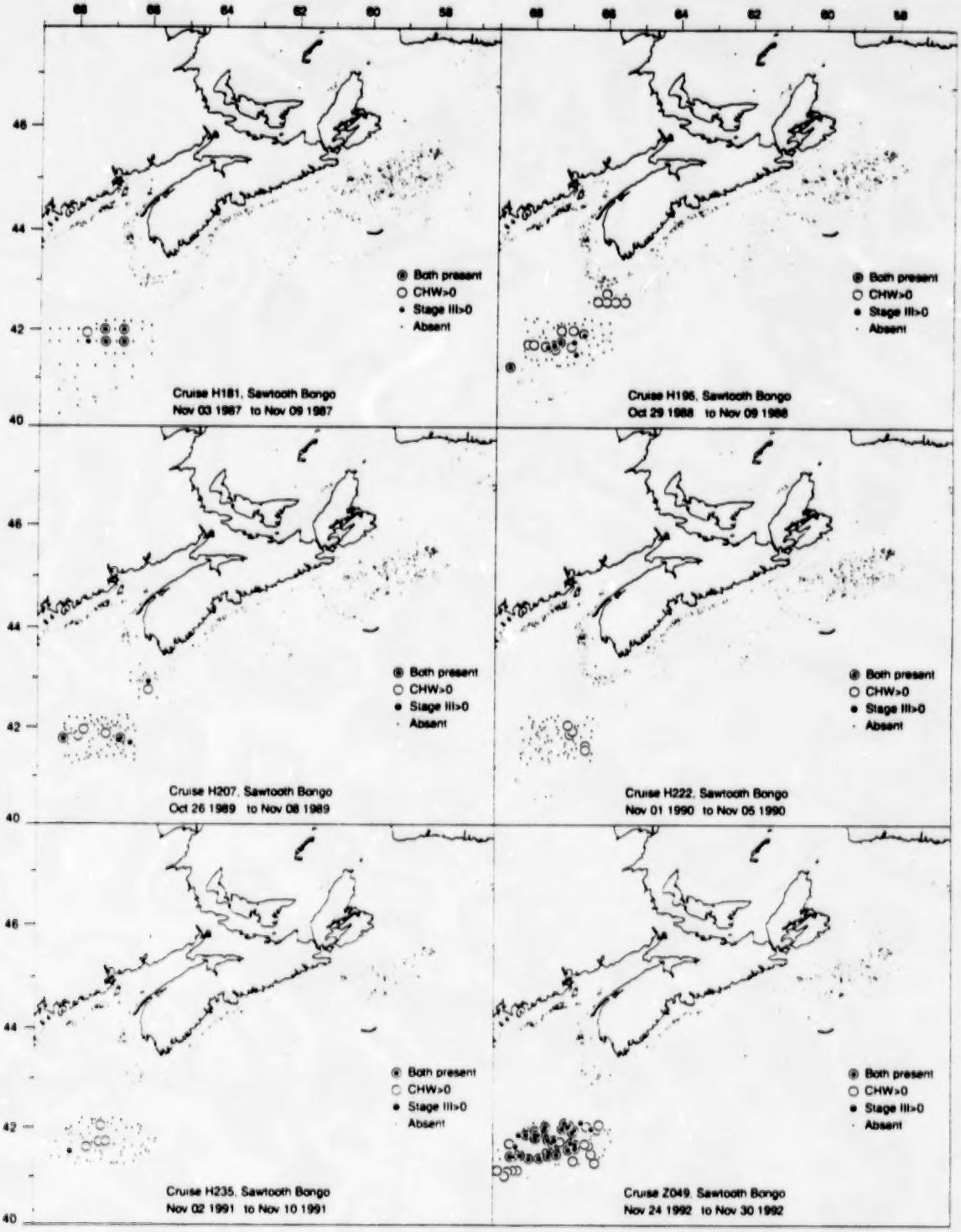

Both present
CHW>0
Stage III>0
Absent
Cruise H181, Sawtooth Bongo
Nov 03 1987 to Nov 09 1987
Cruise H195, Sawtooth Bongo
Oct 29 1988 to Nov 09 1988
Cruise H207, Sawtooth Bongo
Oct 26 1989 to Nov 08 1989
Cruise H222, Sawtooth Bongo
Nov 01 1990 to Nov 05 1990
Cruise H235, Sawtooth Bongo
Nov 02 1991 to Nov 10 1991
Cruise Z049, Sawtooth Bongo
Nov 24 1992 to Nov 30 1992

Fig. 8.2.3. Larval Herring Program-Georges Bank Cruises: Stage III CHW and Stage III cod eggs.

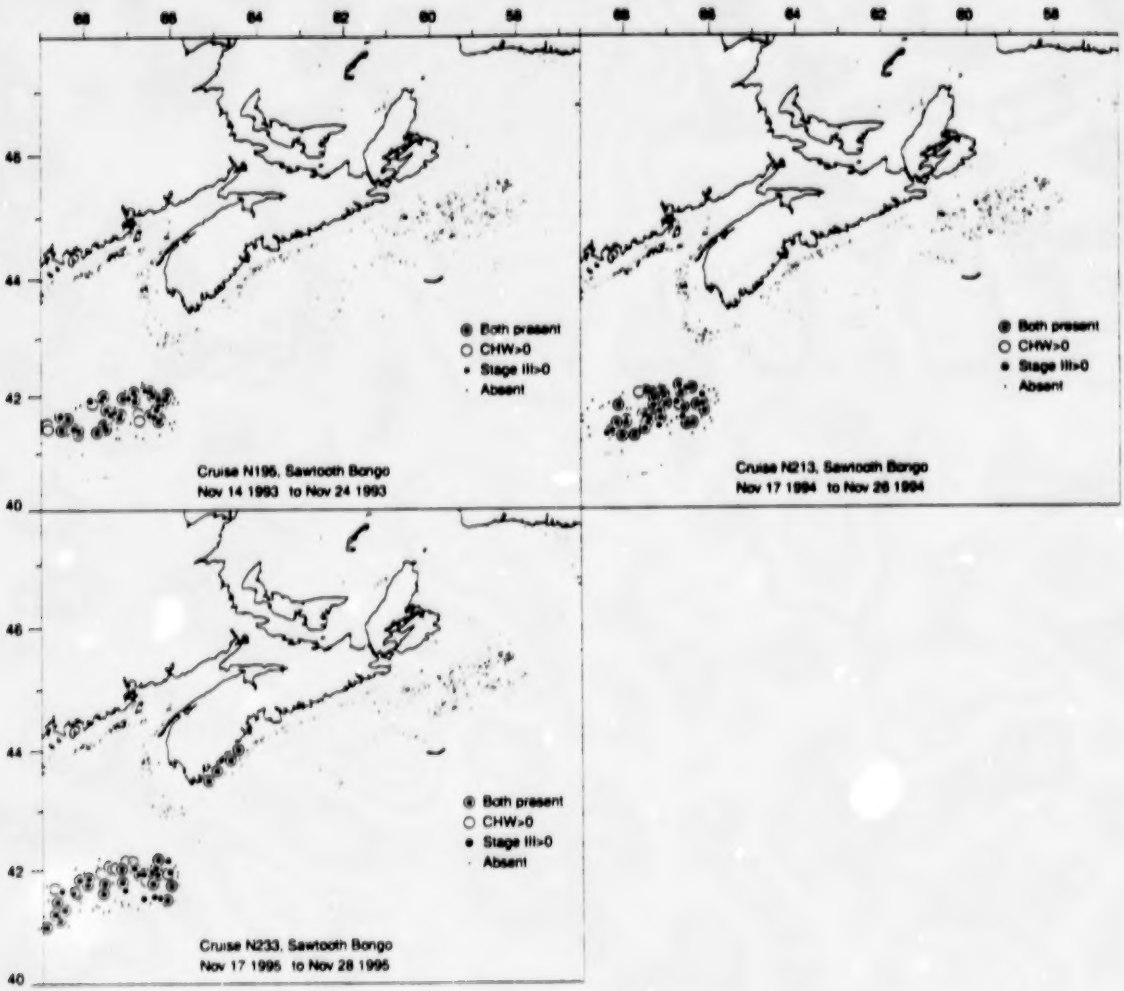


Fig. 8.2.3. (continued).

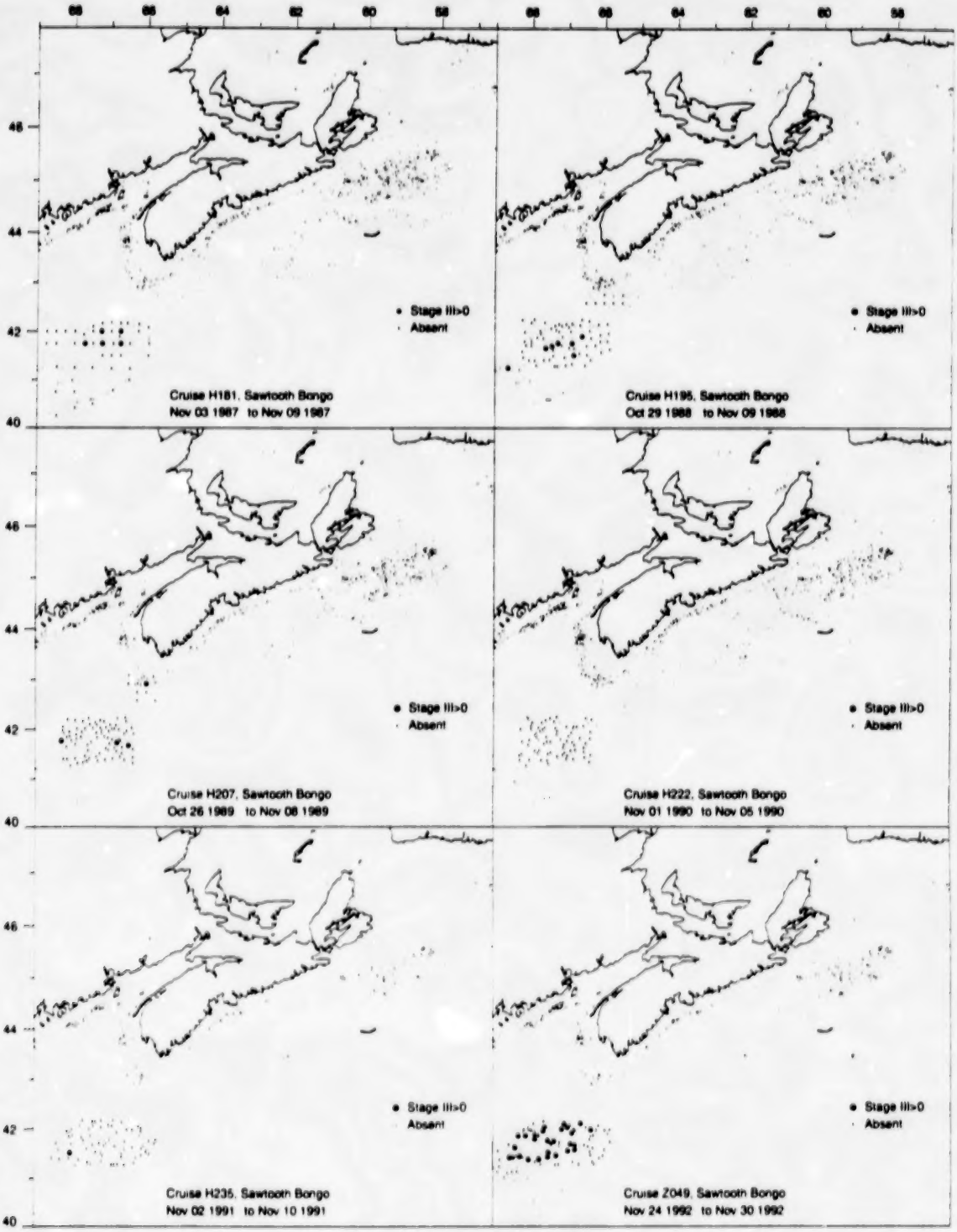

Stage III>0
Absent
Cruise H181. Sawtooth Bongo
Nov 03 1987 to Nov 09 1987
Cruise H195. Sawtooth Bongo
Oct 29 1988 to Nov 09 1988
Cruise H207. Sawtooth Bongo
Oct 26 1989 to Nov 08 1989
Cruise H222. Sawtooth Bongo
Nov 01 1990 to Nov 05 1990
Cruise H235. Sawtooth Bongo
Nov 02 1991 to Nov 10 1991
Cruise Z049. Sawtooth Bongo
Nov 24 1992 to Nov 30 1992

Fig. 8.2.4. Larval Herring Program-Georges Bank Cruises: Stage III cod eggs.

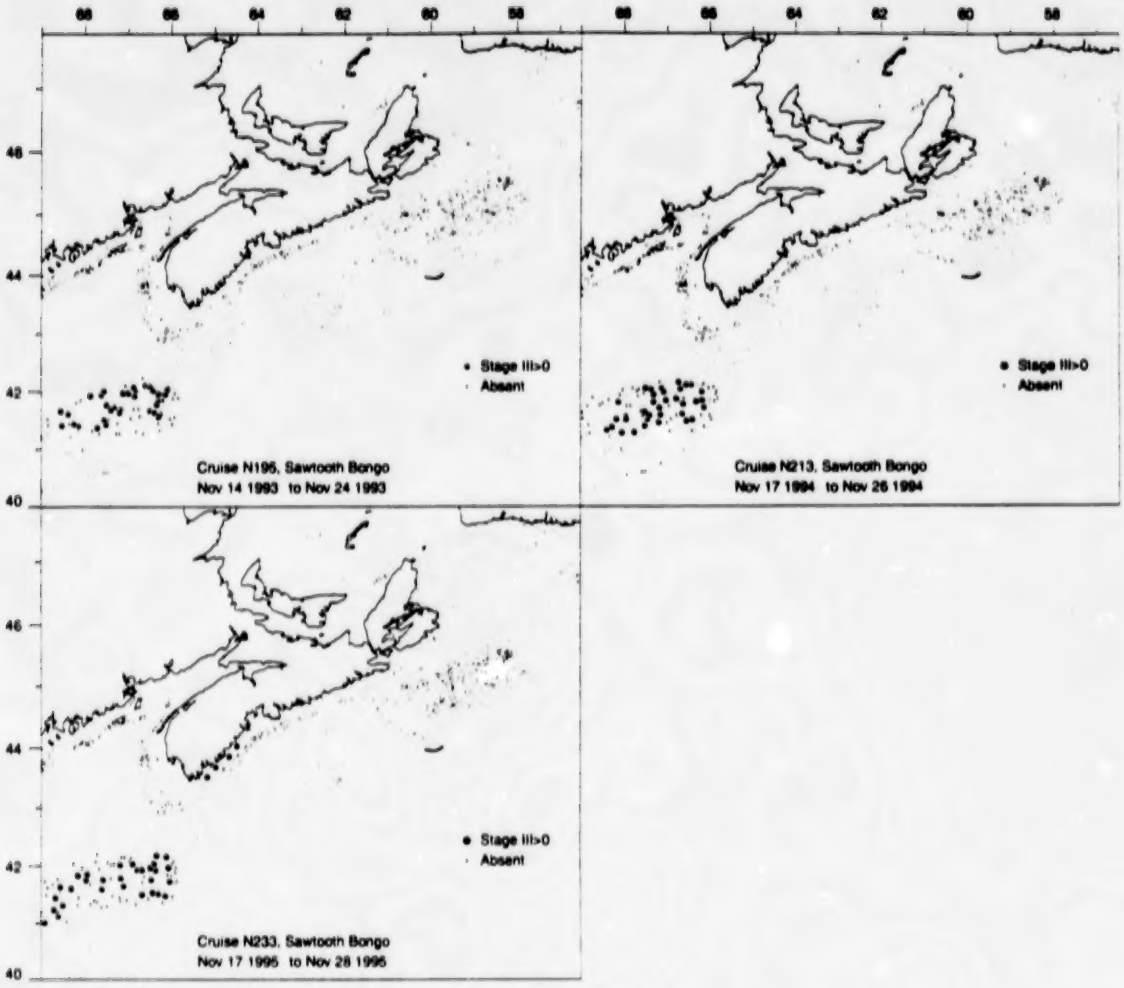


Fig. 8.2.4. (continued).

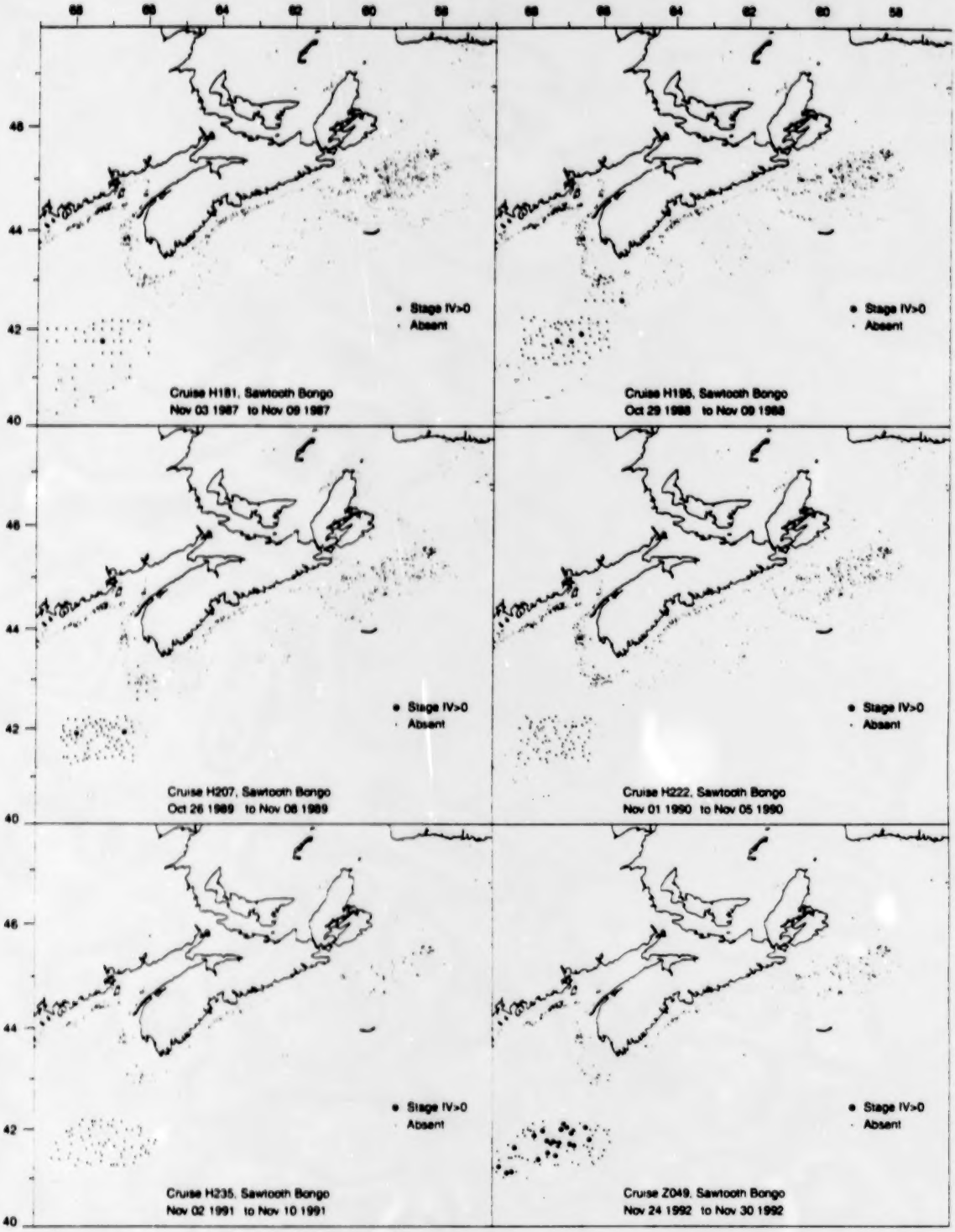


Fig. 8.2.5. Larval Herring Program-Georges Bank Cruises: Stage IV cod eggs.

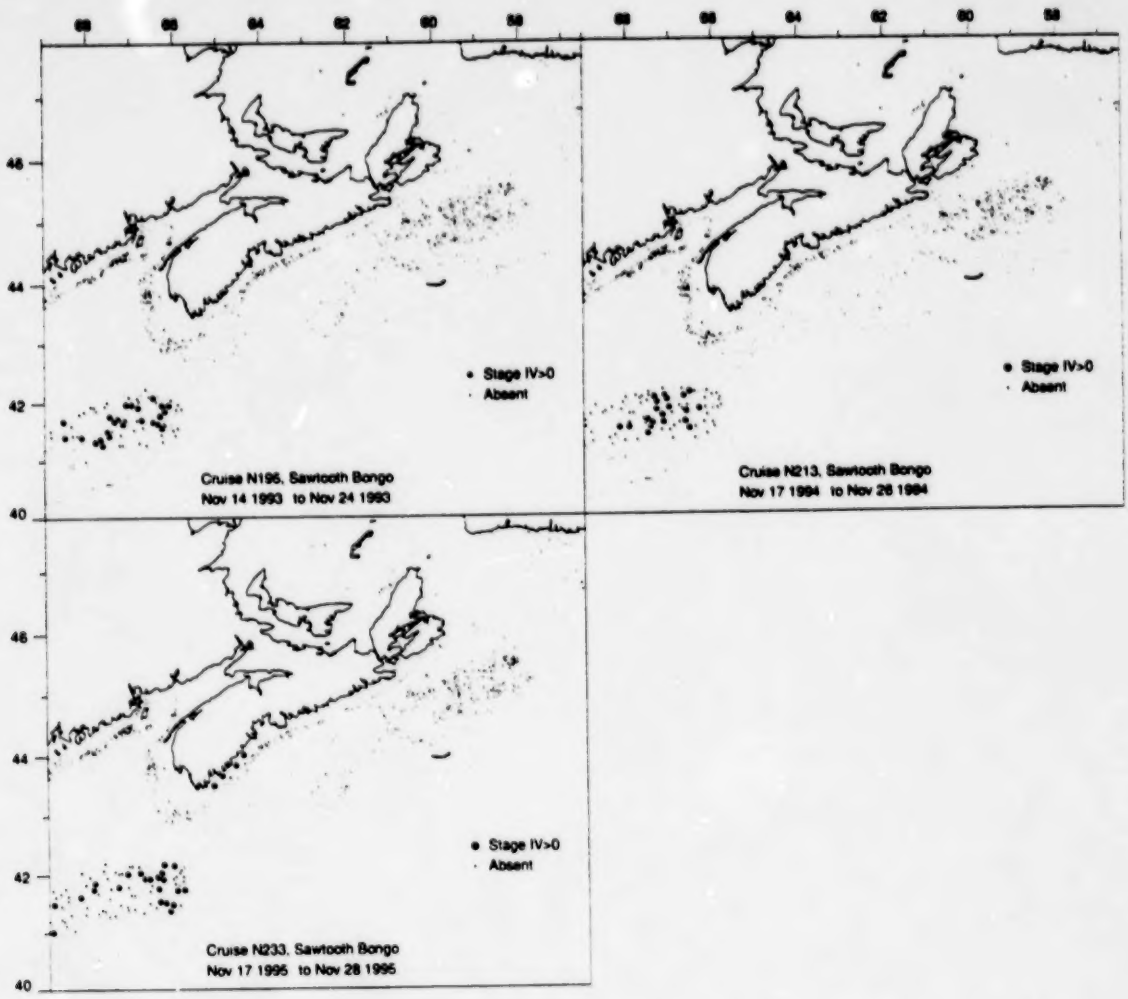


Fig. 8.2.5. (continued).

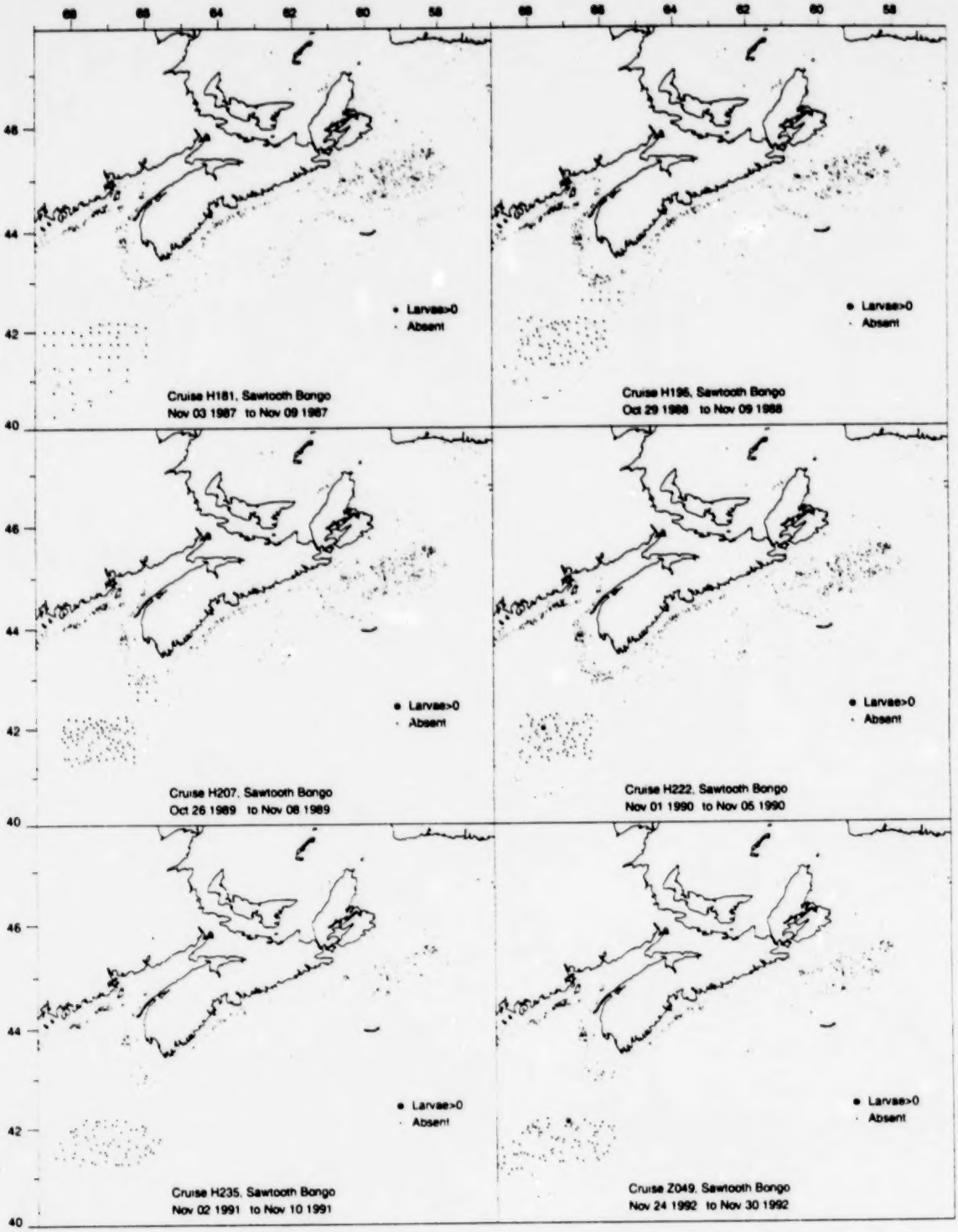


Fig. 8.2.6. Larval Herring Program-Georges Bank Cruises: Cod larvae (1-7mm).

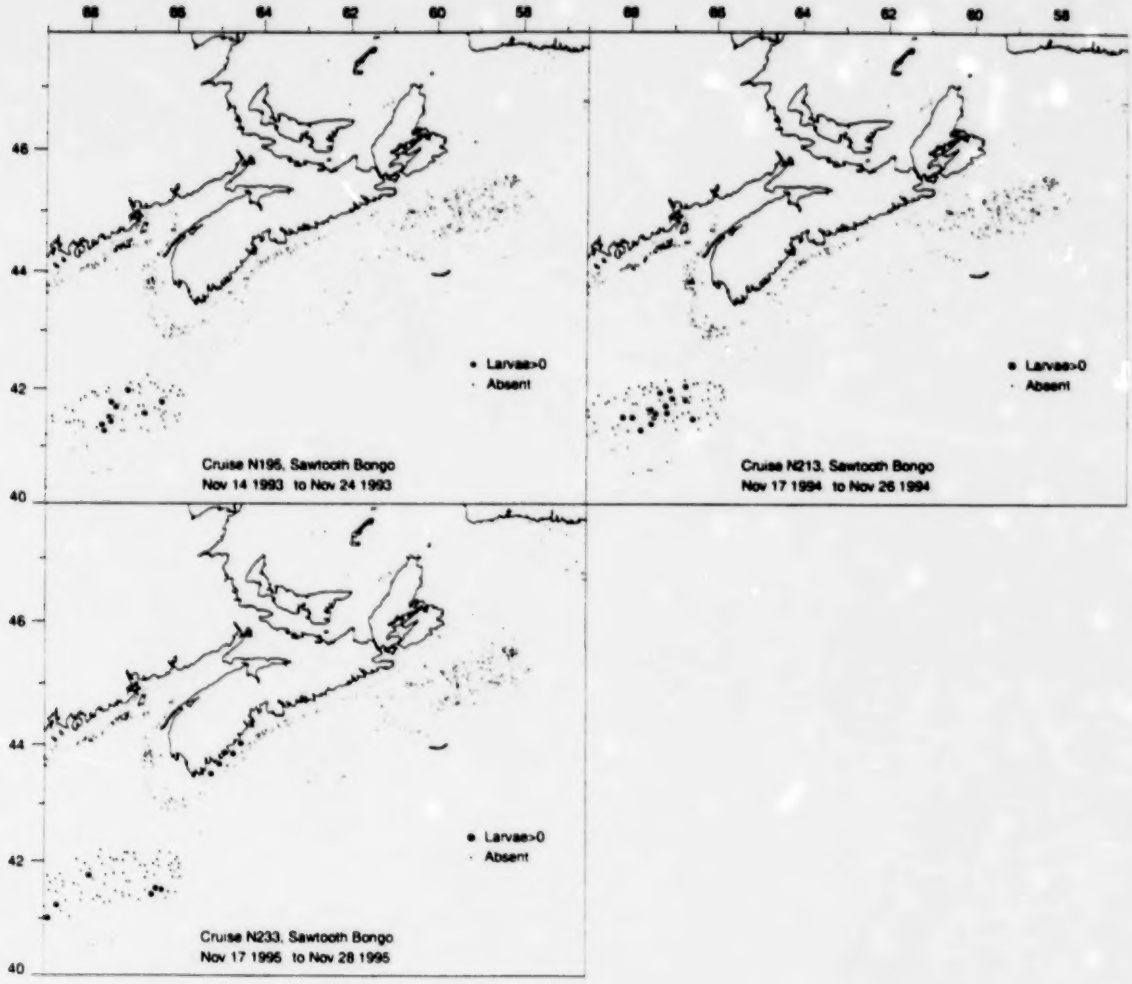


Fig. 8.2.6. (continued).

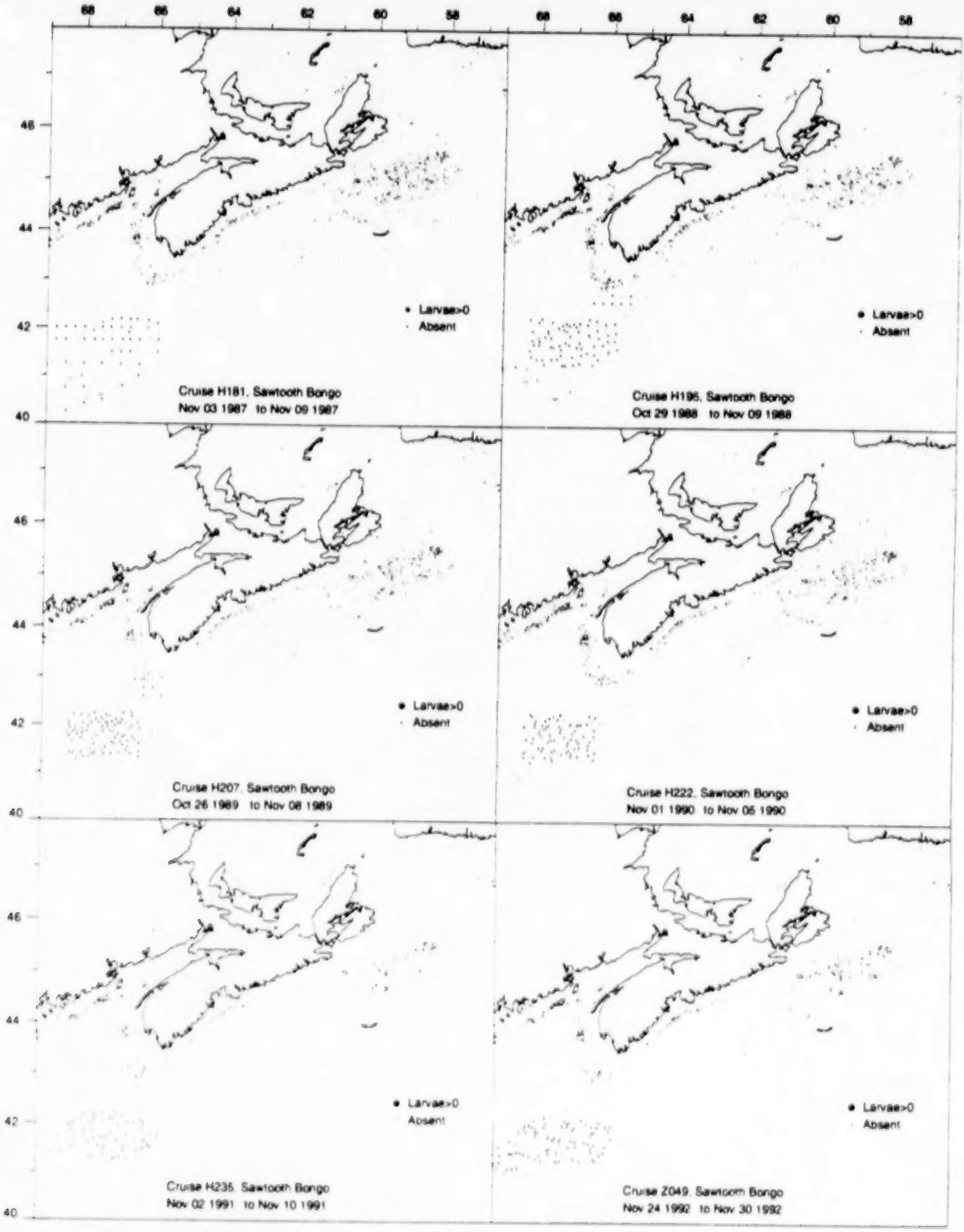
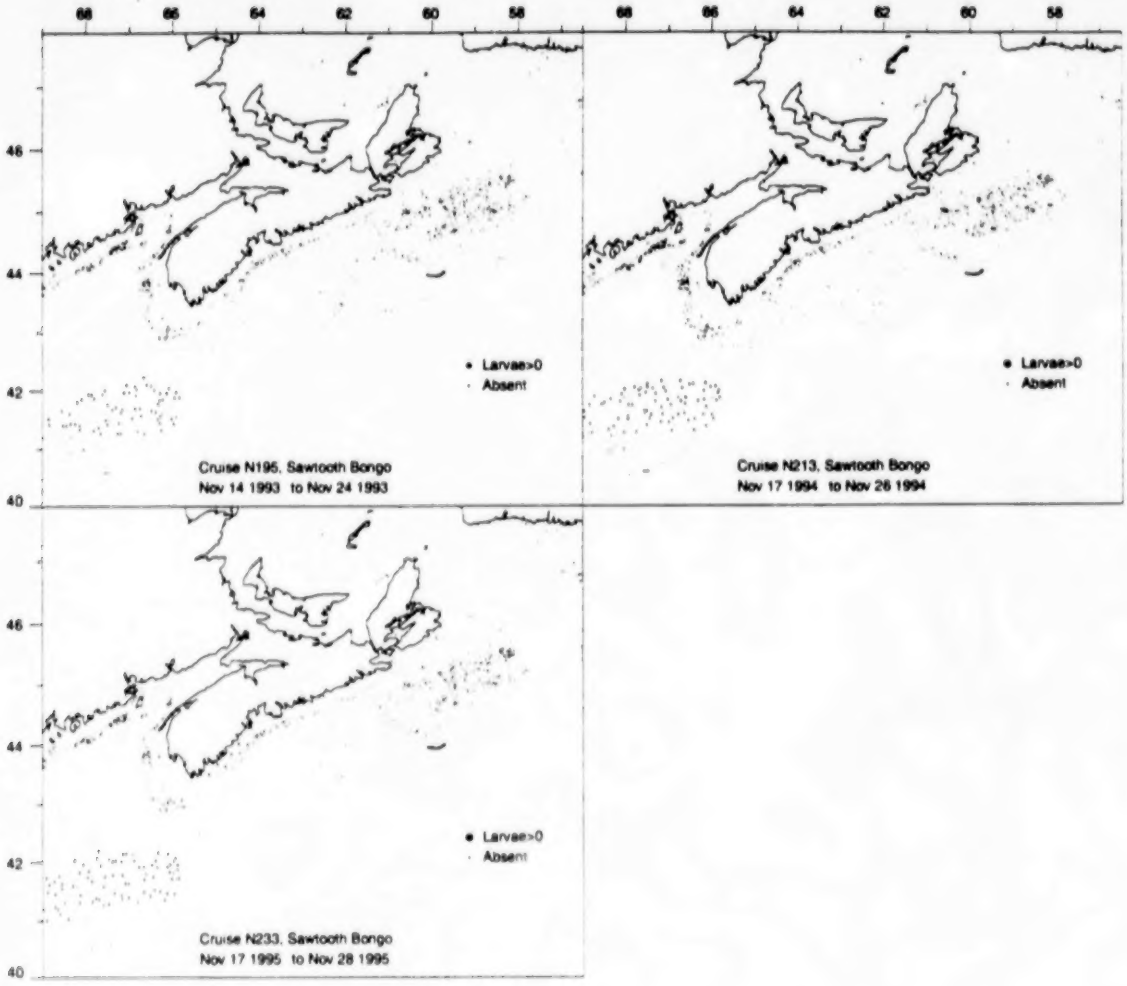


Fig. 8.2.7. Larval Herring Program-Georges Bank Cruises: Cod larvae (7+mm).



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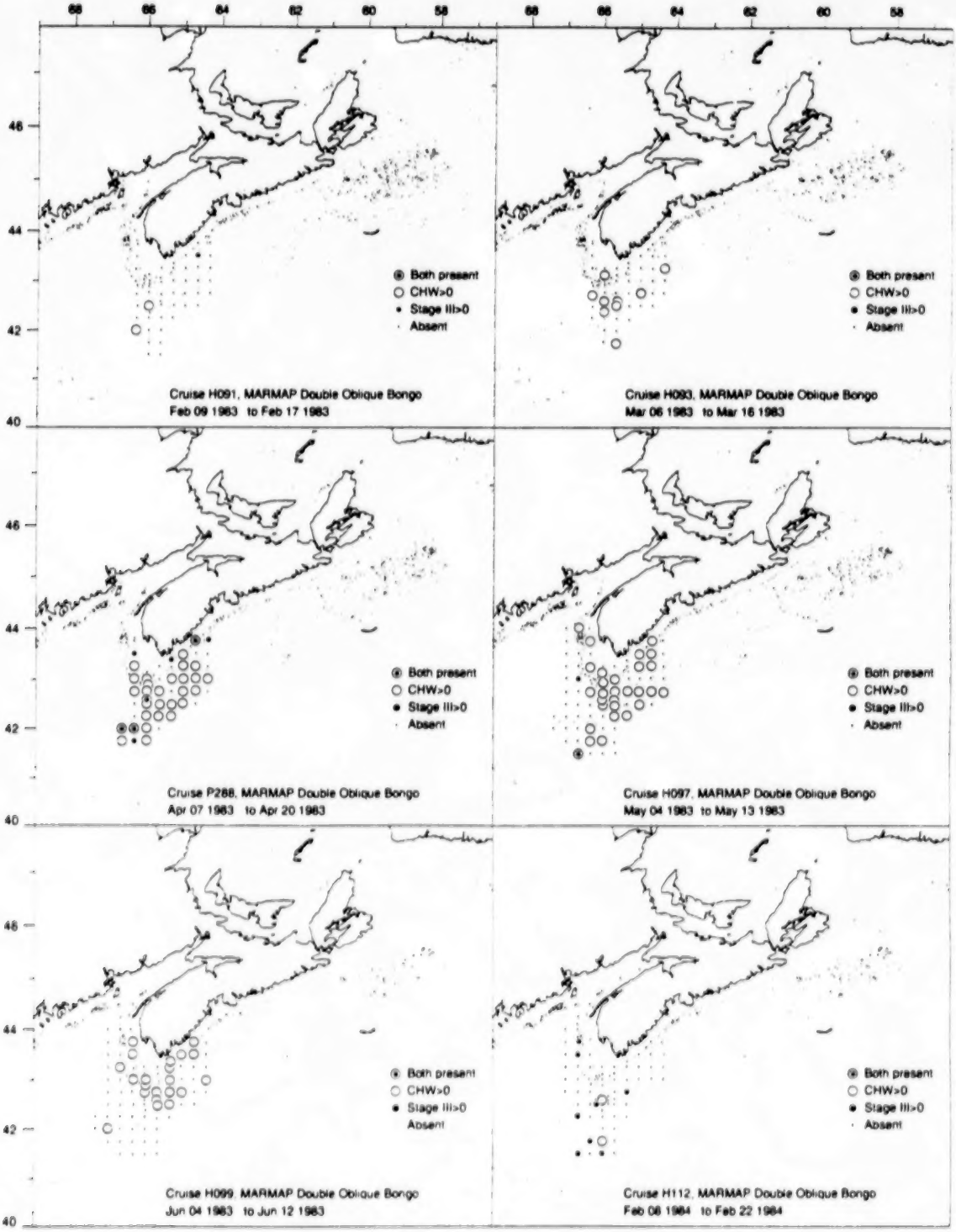

Fig. 8.3.1. Fisheries Ecology Program Cruises: Stage I CHW and Stage III cod eggs.

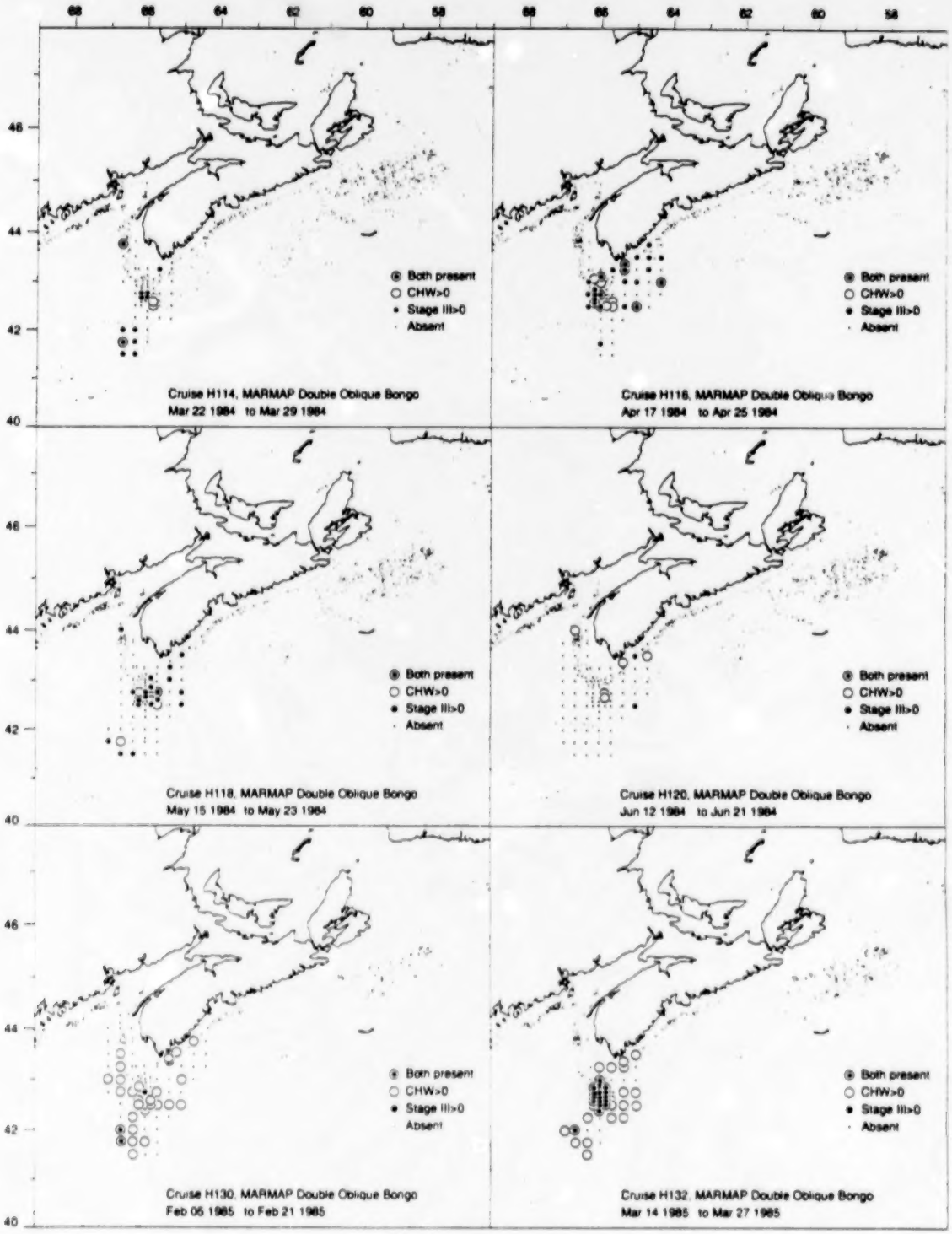
Both present
CHW>0
Stage III>0
Absent
Cruise H114, MARMAP Double Oblique Bongo
Mar 22 1984 to Mar 29 1984
Cruise H116, MARMAP Double Oblique Bongo
Apr 17 1984 to Apr 25 1984
Cruise H118, MARMAP Double Oblique Bongo
May 15 1984 to May 23 1984
Cruise H120, MARMAP Double Oblique Bongo
Jun 12 1984 to Jun 21 1984
Cruise H130, MARMAP Double Oblique Bongo
Feb 05 1985 to Feb 21 1985
Cruise H132, MARMAP Double Oblique Bongo
Mar 14 1985 to Mar 27 1985

Fig. 8.3.1. (continued).

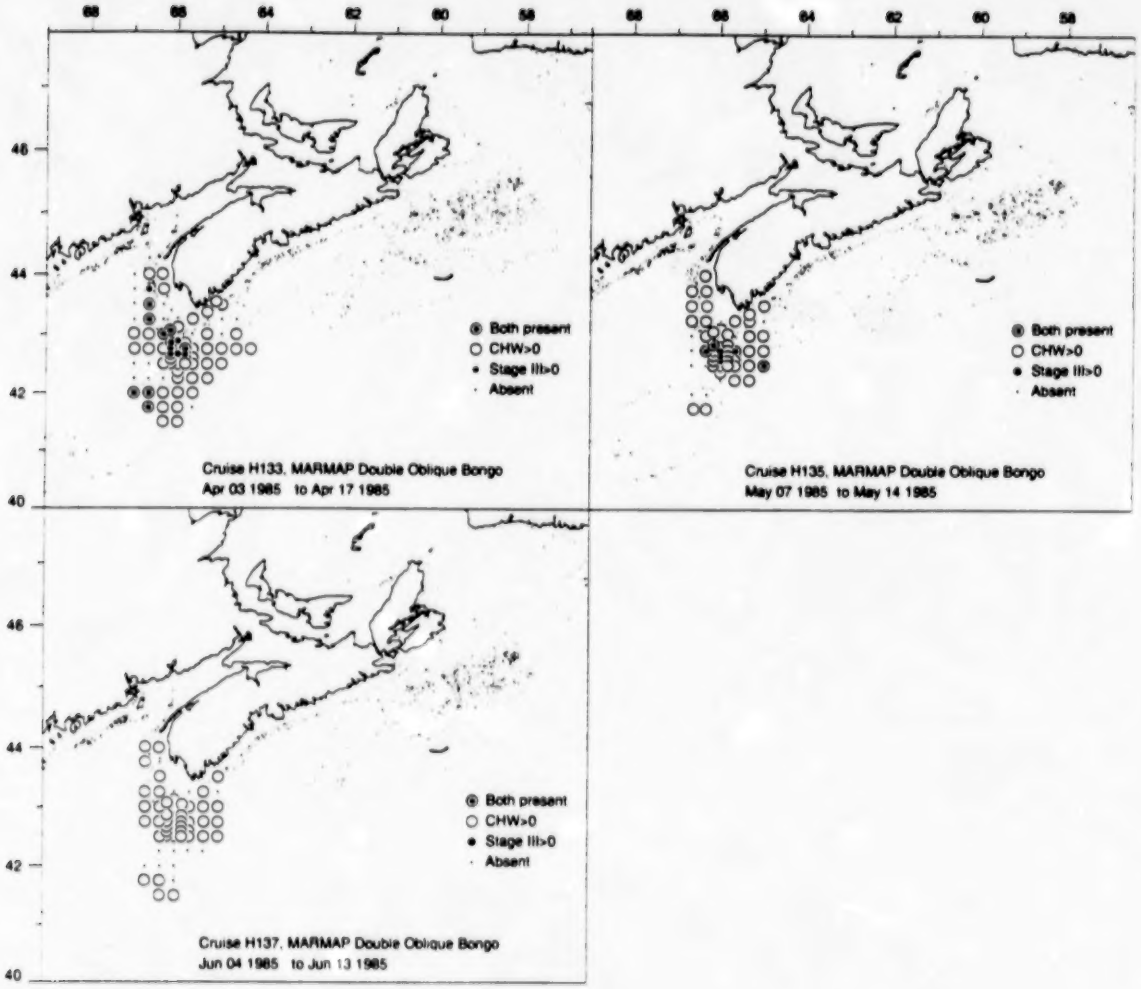

Fig. 8.3.1. (continued).

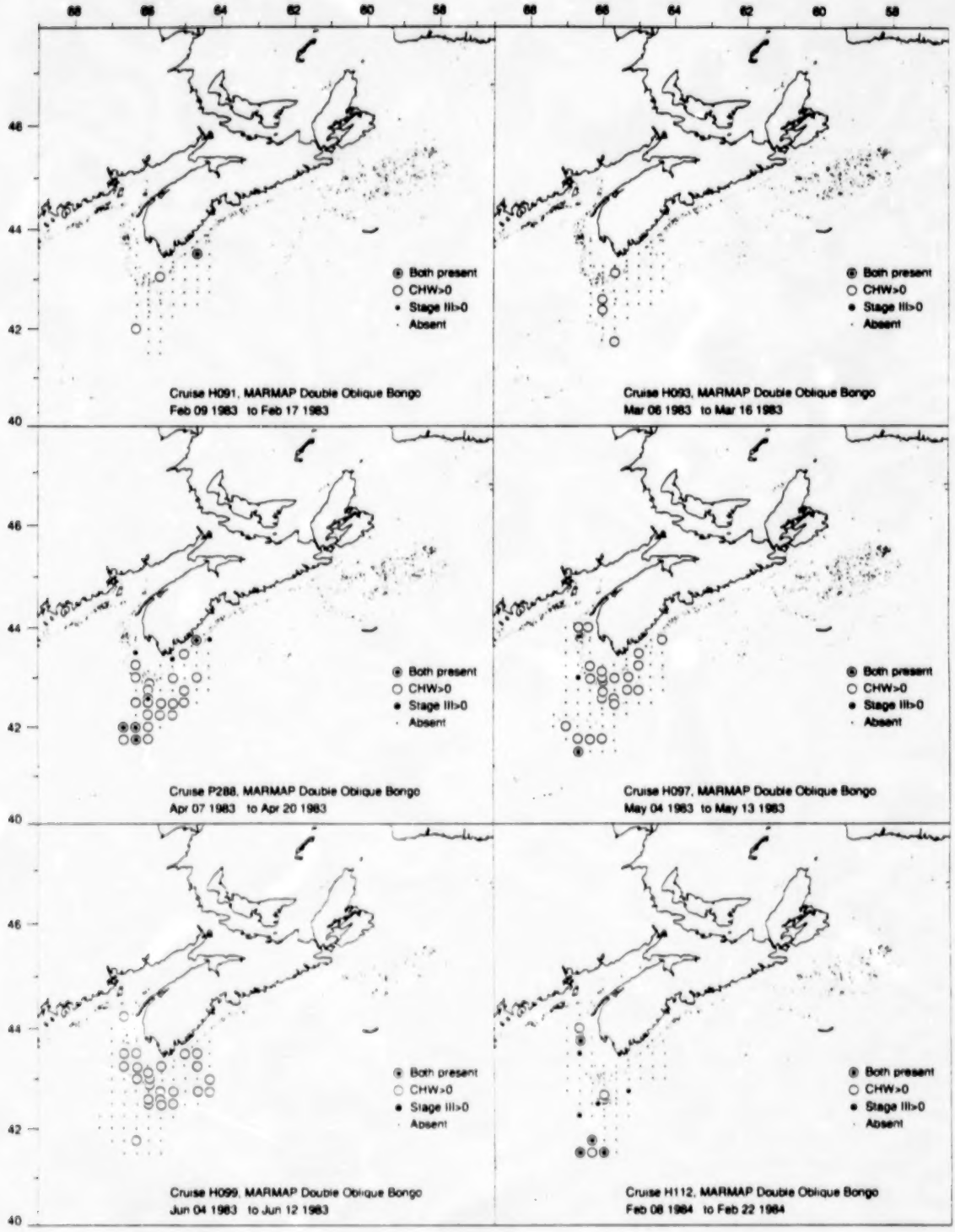
Both present
CHW>0
Stage III>0
Absent
Cruise H091, MARMAP Double Oblique Bongo
Feb 09 1983 to Feb 17 1983
Cruise H093, MARMAP Double Oblique Bongo
Mar 06 1983 to Mar 16 1983
Cruise P288, MARMAP Double Oblique Bongo
Apr 07 1983 to Apr 20 1983
Cruise H097, MARMAP Double Oblique Bongo
May 04 1983 to May 13 1983
Cruise H099, MARMAP Double Oblique Bongo
Jun 04 1983 to Jun 12 1983
Cruise H112, MARMAP Double Oblique Bongo
Feb 08 1984 to Feb 22 1984

Fig. 8.3.2. Fisheries Ecology Program Cruises: Stage II CHW and Stage III cod eggs.

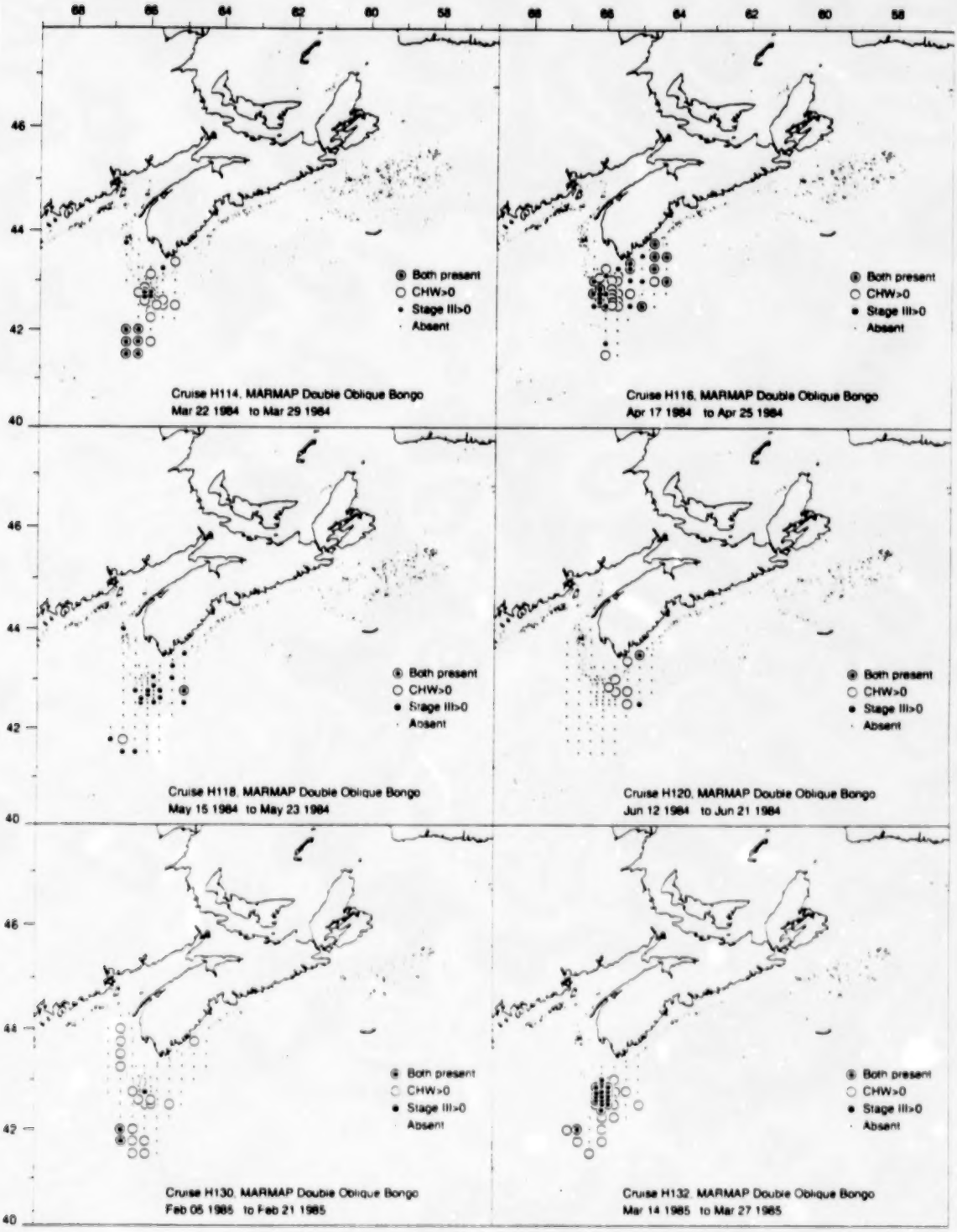
Both present
CHW>0
Stage III>0
Absent
Cruise H114, MARMAP Double Oblique Bongo
Mar 22 1984 to Mar 29 1984
Cruise H116, MARMAP Double Oblique Bongo
Apr 17 1984 to Apr 25 1984
Cruise H118, MARMAP Double Oblique Bongo
May 15 1984 to May 23 1984
Cruise H120, MARMAP Double Oblique Bongo
Jun 12 1984 to Jun 21 1984
Cruise H130, MARMAP Double Oblique Bongo
Feb 05 1985 to Feb 21 1985
Cruise H132, MARMAP Double Oblique Bongo
Mar 14 1985 to Mar 27 1985

Fig. 8.3.2. (continued).

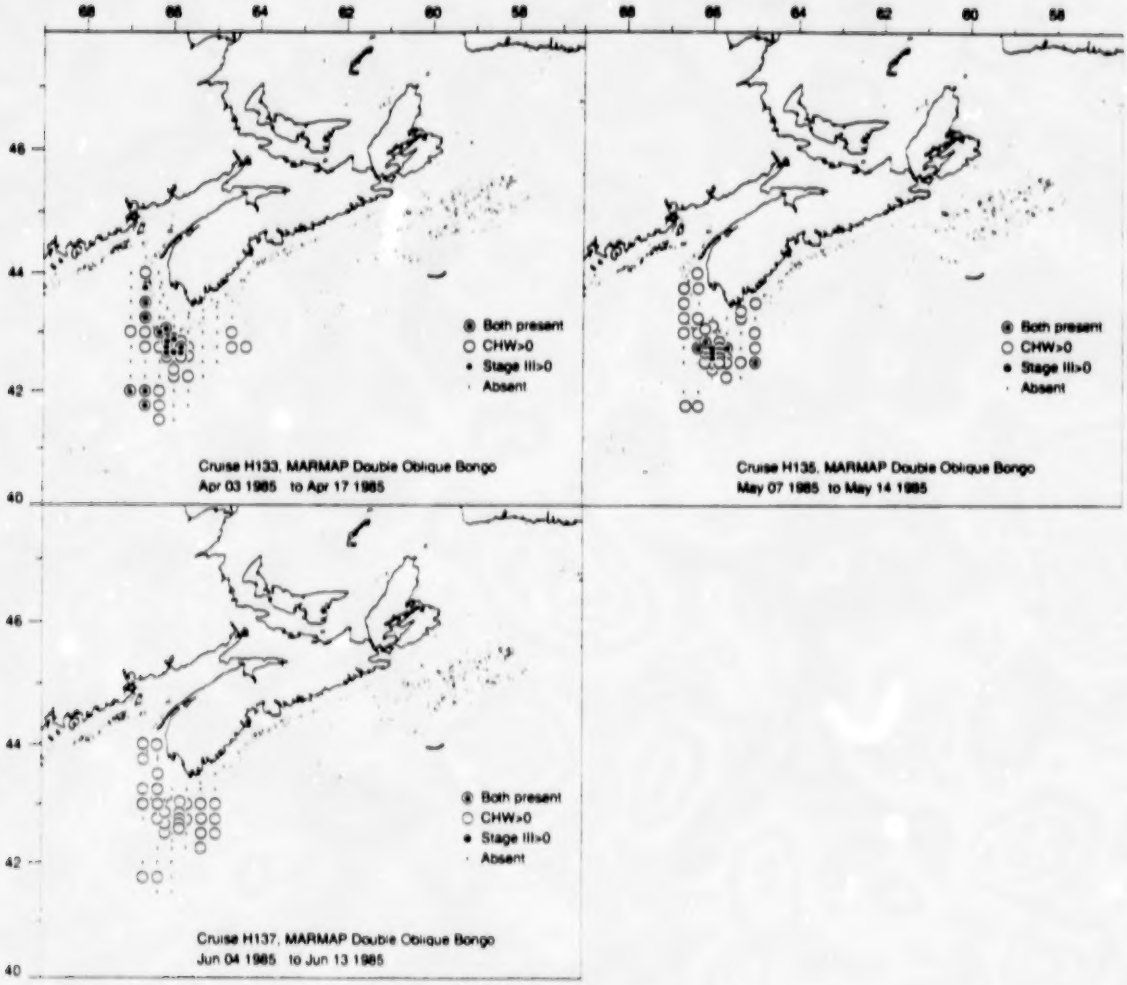
Both present
CHW>0
Stage III>0
Absent
Cruise H133, MARMAP Double Oblique Bongo
Apr 03 1985 to Apr 17 1985
Cruise H135, MARMAP Double Oblique Bongo
May 07 1985 to May 14 1985
Cruise H137, MARMAP Double Oblique Bongo
Jun 04 1985 to Jun 13 1985

Fig. 8.3.2. (continued).

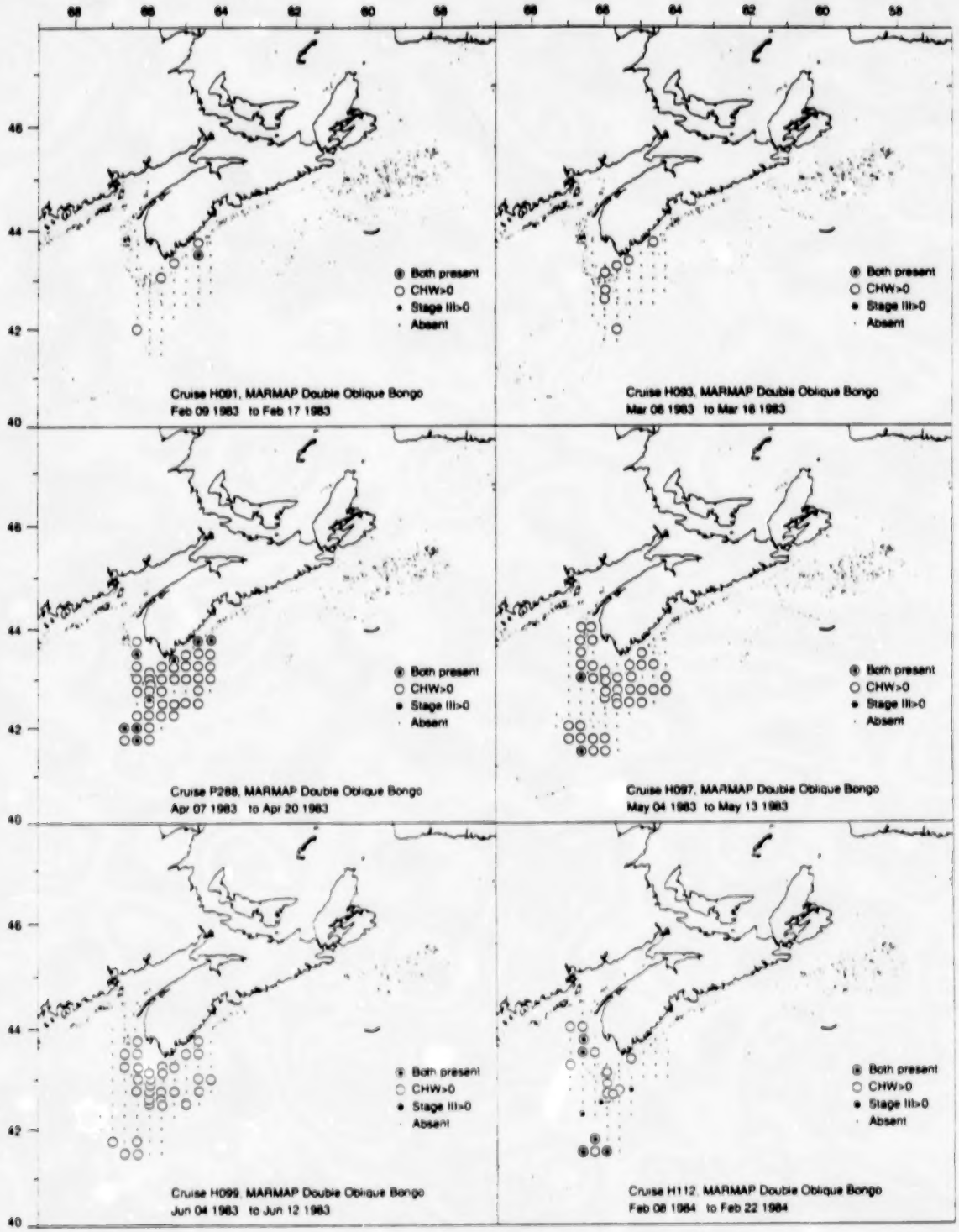
Both present
CHW>0
Stage III>0
Absent
Cruise H091, MARMAP Double Oblique Bongo
Feb 09 1983 to Feb 17 1983
Cruise H093, MARMAP Double Oblique Bongo
Mar 06 1983 to Mar 16 1983
Cruise P288, MARMAP Double Oblique Bongo
Apr 07 1983 to Apr 20 1983
Cruise H097, MARMAP Double Oblique Bongo
May 04 1983 to May 13 1983
Cruise H099, MARMAP Double Oblique Bongo
Jun 04 1983 to Jun 12 1983
Cruise H112, MARMAP Double Oblique Bongo
Feb 08 1984 to Feb 22 1984

Fig. 8.3.3. Fisheries Ecology Program Cruises: Stage III CHW and Stage III cod eggs.

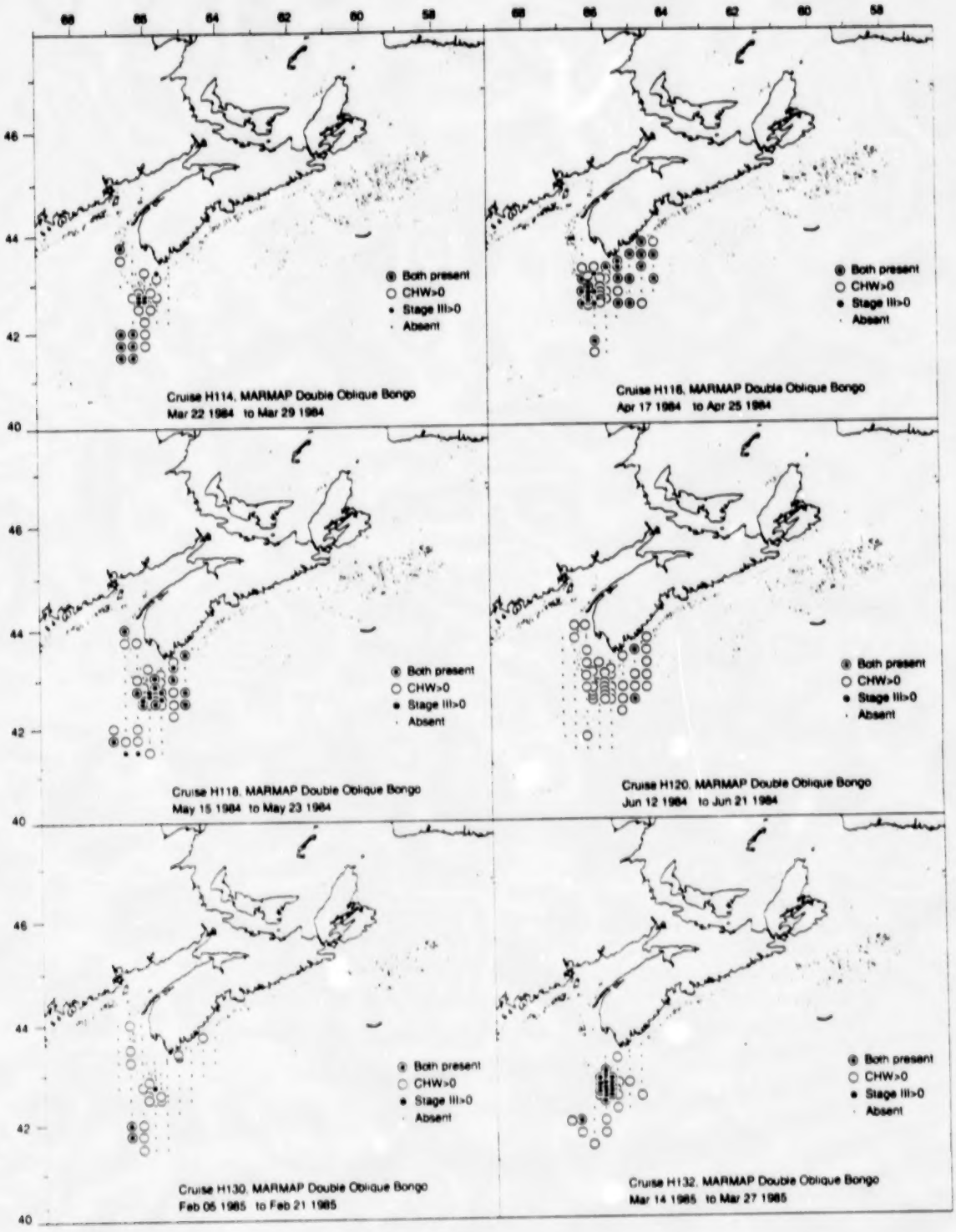
Both present
CHW>0
Stage III>0
Absent
Cruise H114, MARMAP Double Oblique Bongo
Mar 22 1984 to Mar 29 1984
Cruise H116, MARMAP Double Oblique Bongo
Apr 17 1984 to Apr 25 1984
Cruise H118, MARMAP Double Oblique Bongo
May 15 1984 to May 23 1984
Cruise H120, MARMAP Double Oblique Bongo
Jun 12 1984 to Jun 21 1984
Cruise H130, MARMAP Double Oblique Bongo
Feb 05 1985 to Feb 21 1985
Cruise H132, MARMAP Double Oblique Bongo
Mar 14 1985 to Mar 27 1985

Fig. 8.3.3. (continued).

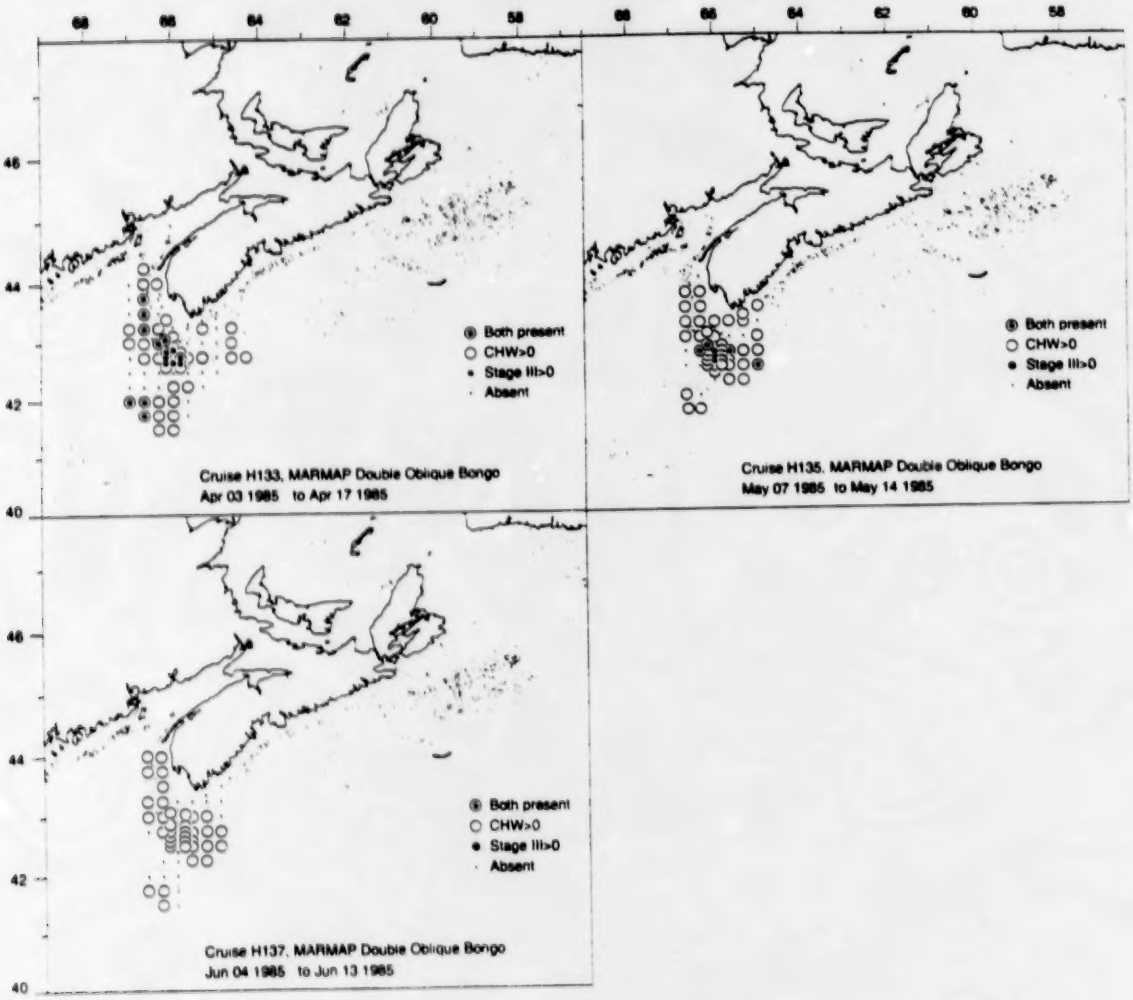
Both present
CHW>0
Stage III>0
Absent
Cruise H133. MARMAP Double Oblique Bongo
Apr 03 1985 to Apr 17 1985
Cruise H135. MARMAP Double Oblique Bongo
May 07 1985 to May 14 1985
Cruise H137. MARMAP Double Oblique Bongo
Jun 04 1985 to Jun 13 1985

Fig. 8.3.3. (continued).

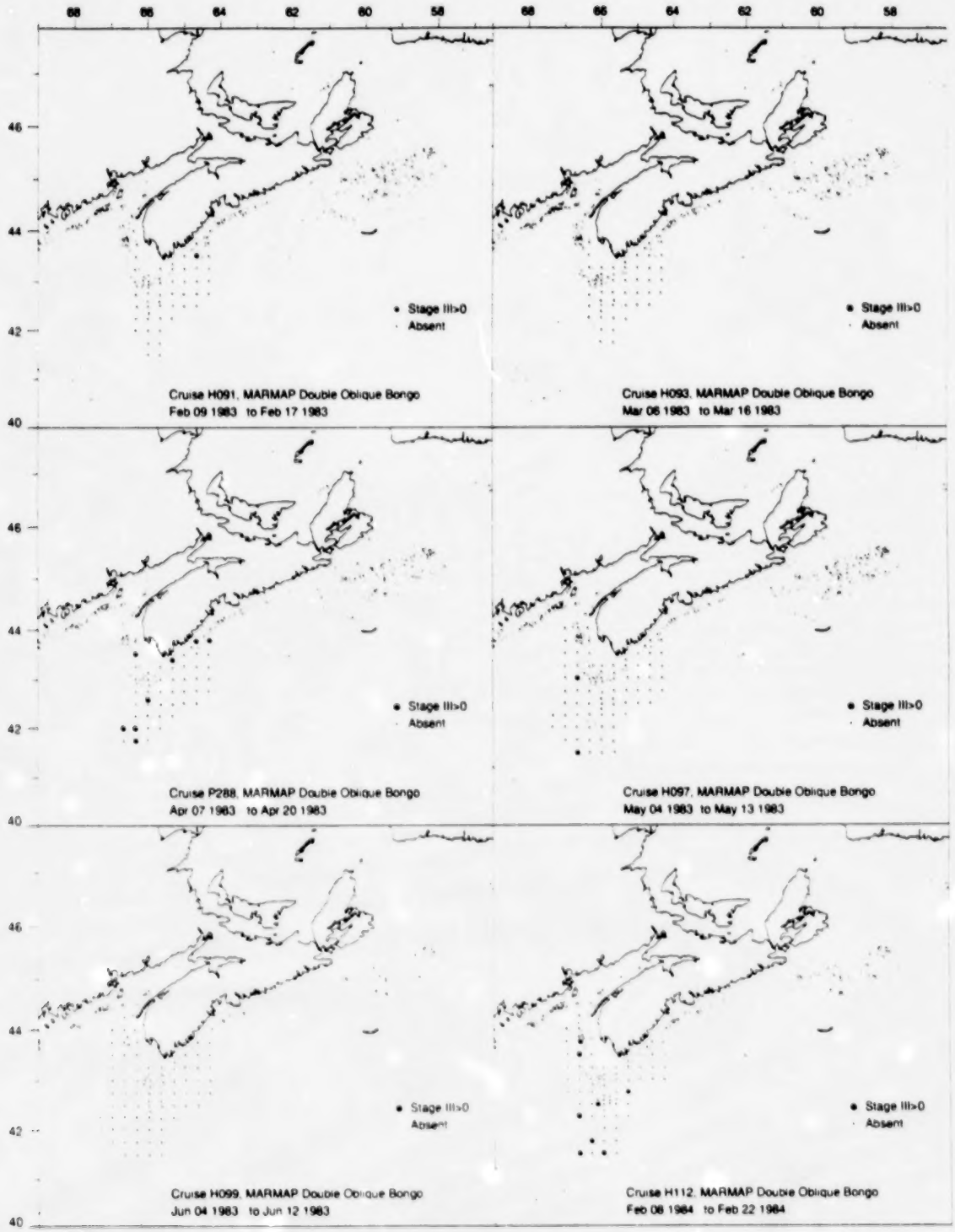

Fig. 8.3.4. Fisheries Ecology Program Cruises: Stage III cod eggs.

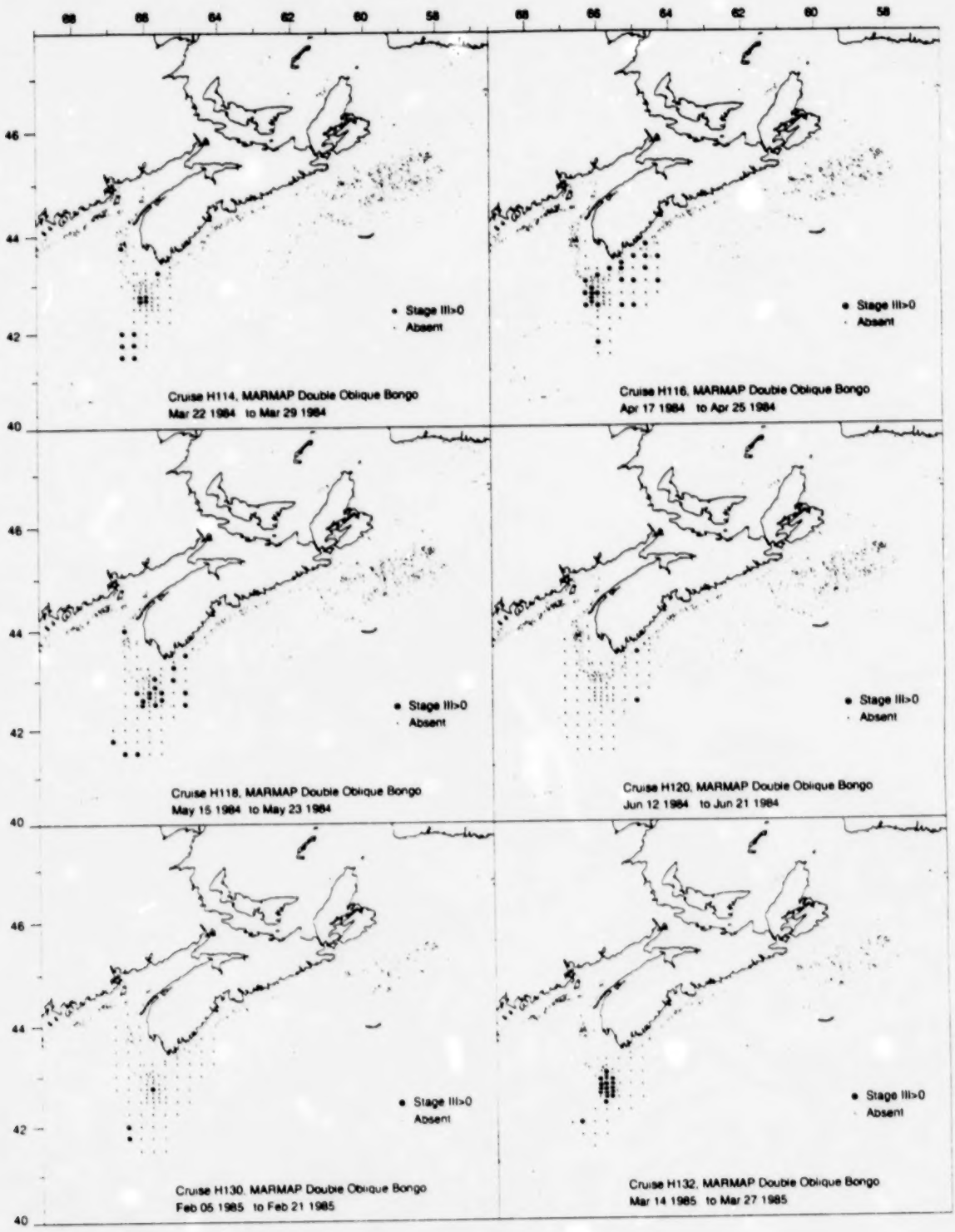

Fig. 8.3.4. (continued).

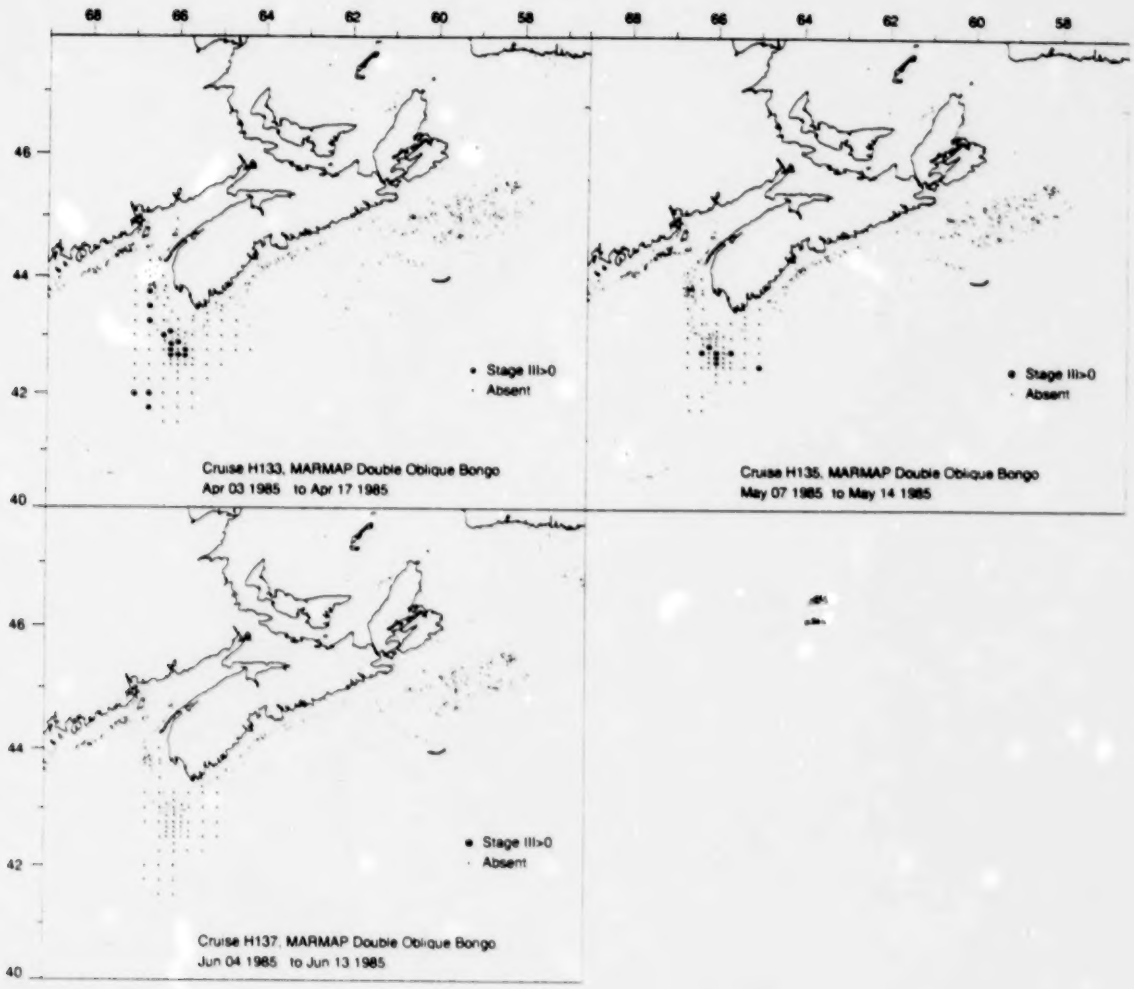

Fig. 8.3.4. (continued).

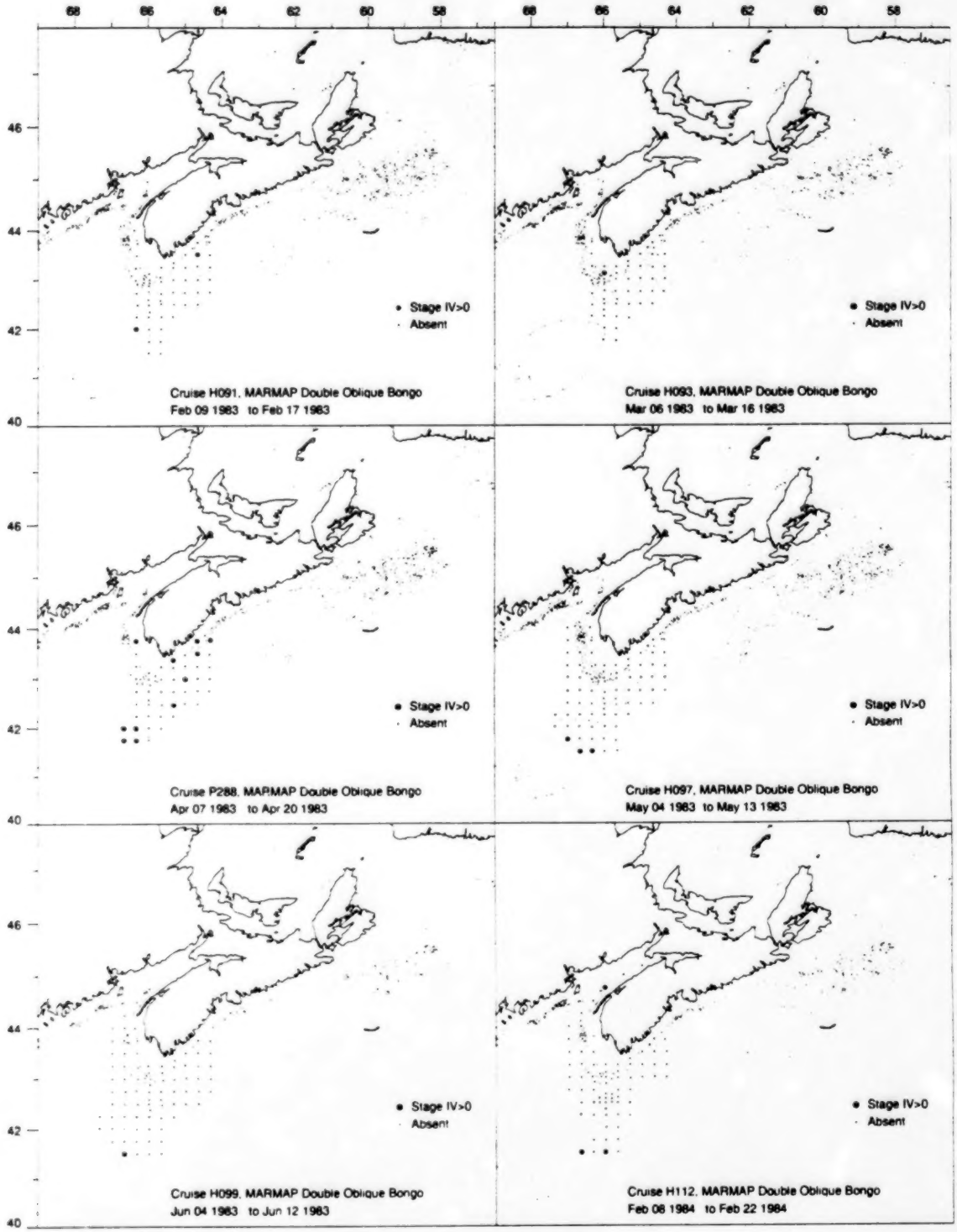

Fig. 8.3.5. Fisheries Ecology Program Cruises: Stage IV cod eggs.

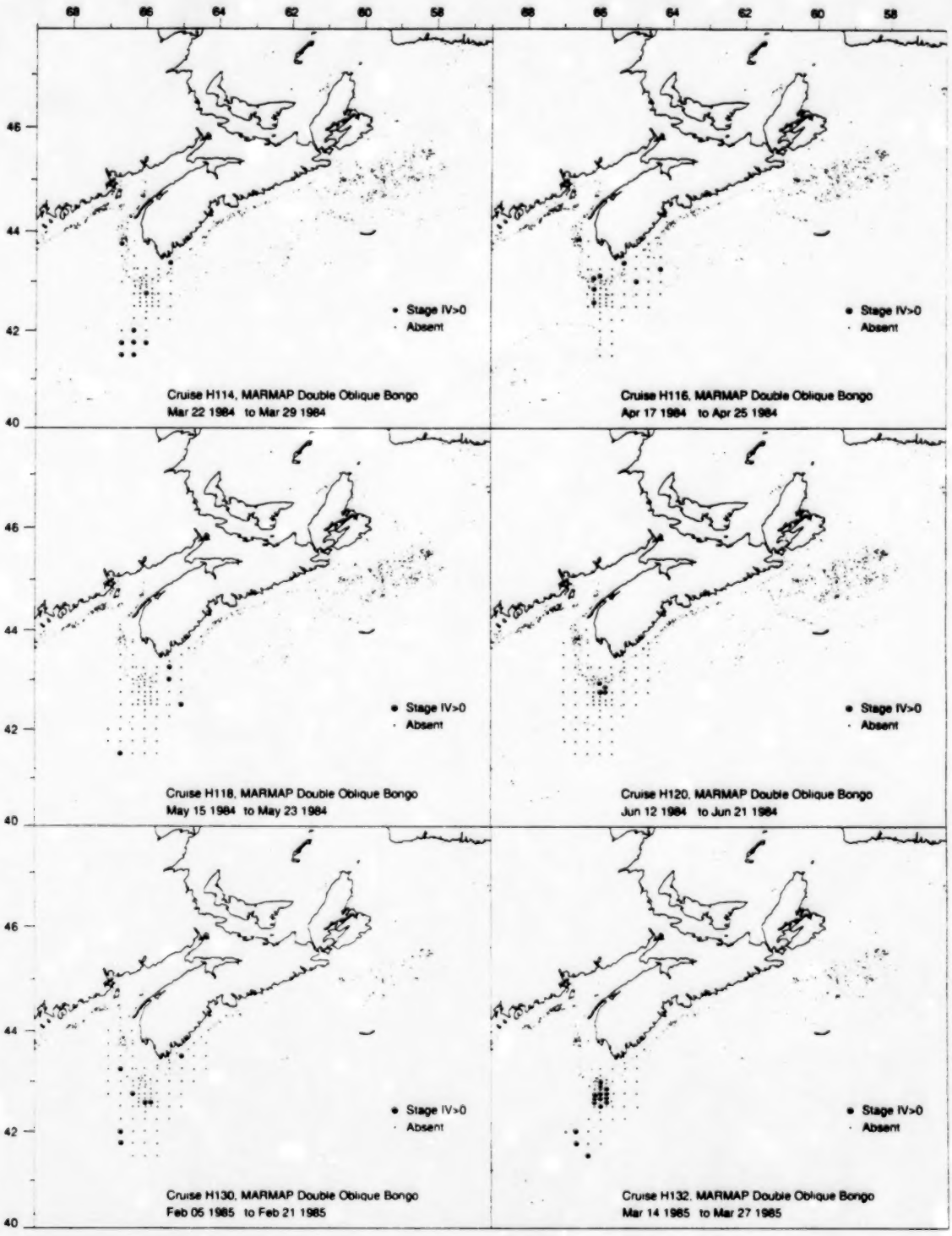

Fig. 8.3.5. (continued).

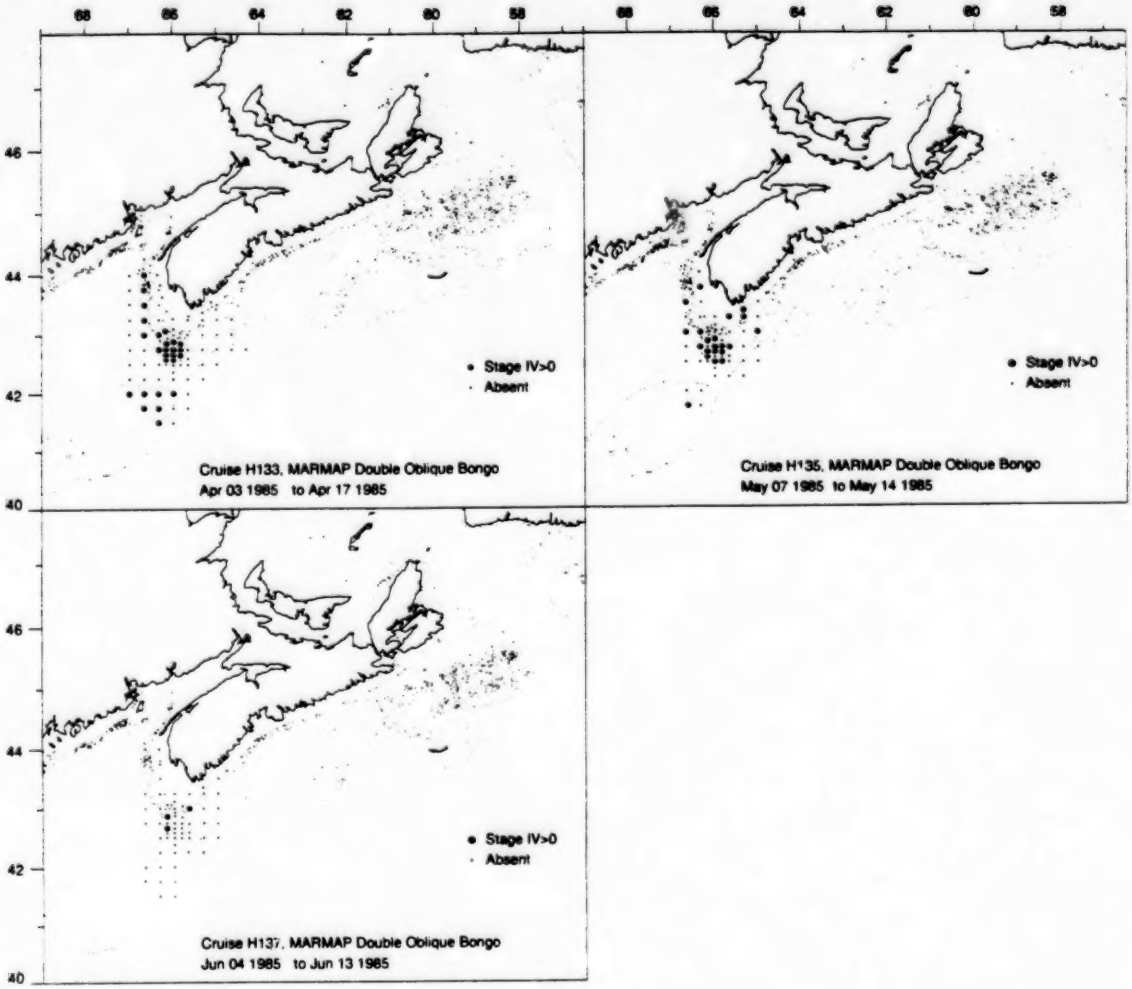

Fig. 8.3.5. (continued).

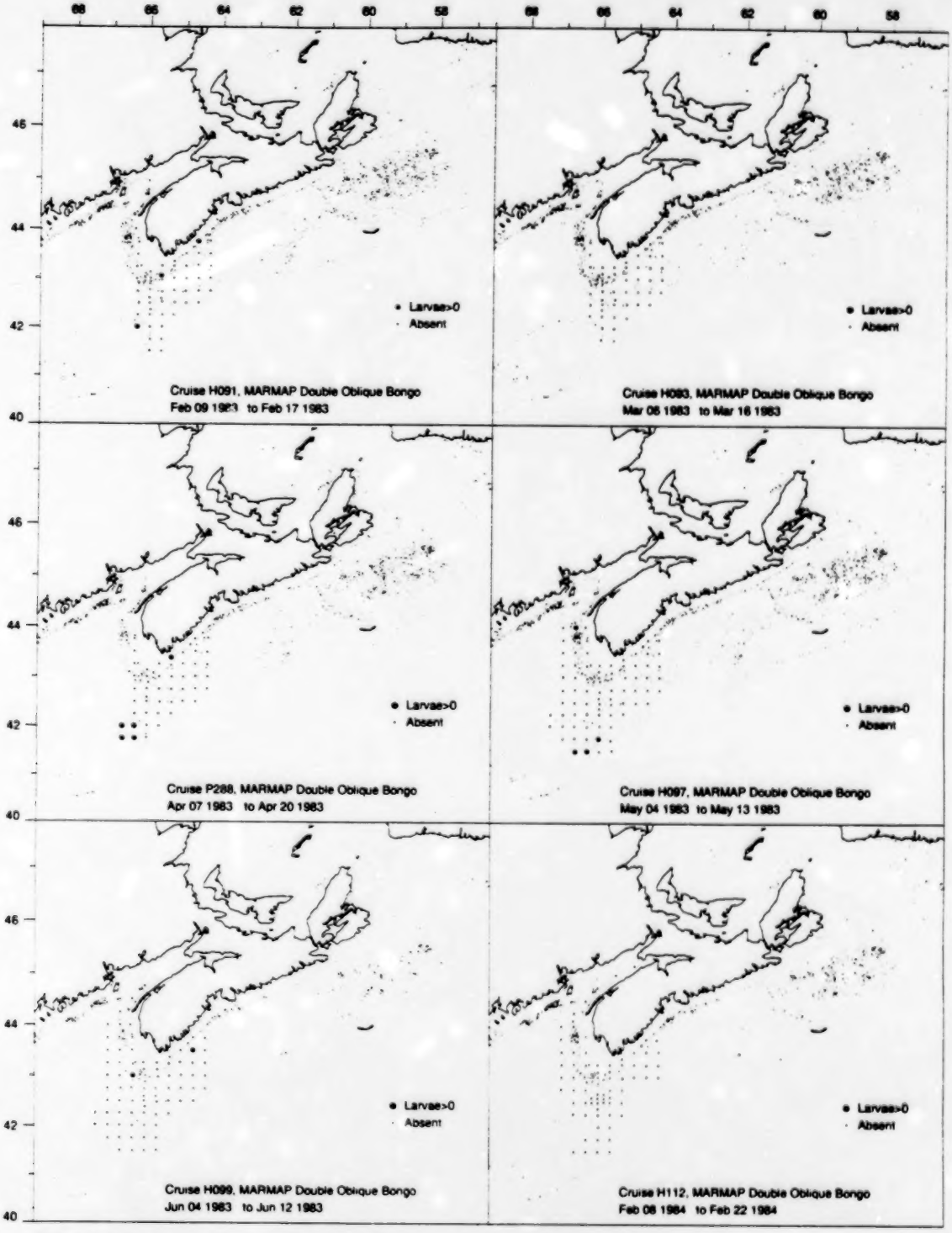

Fig. 8.3.6. Fisheries Ecology Program Cruises: Cod larvae (1-7mm).

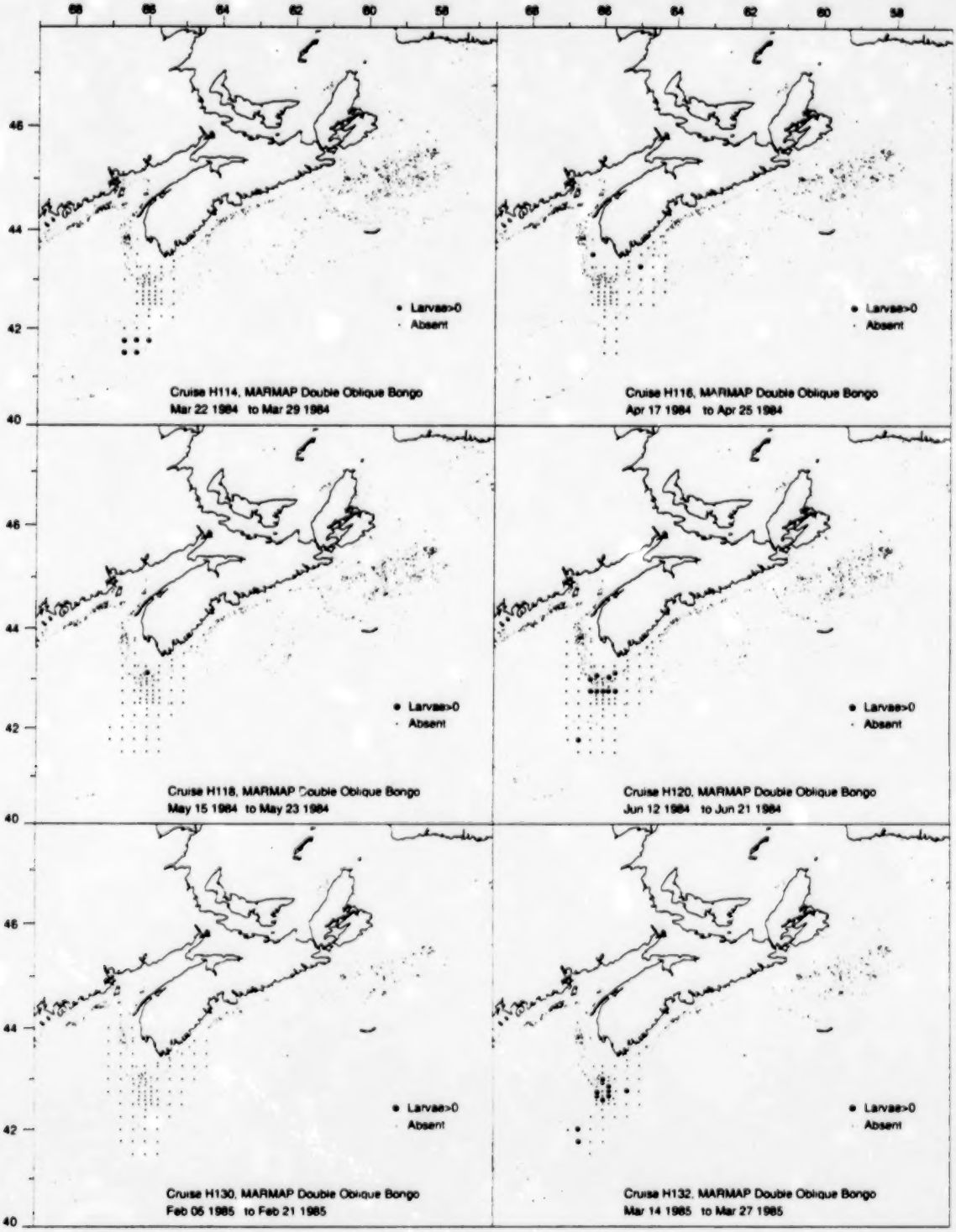

Fig. 8.3.6. (continued).

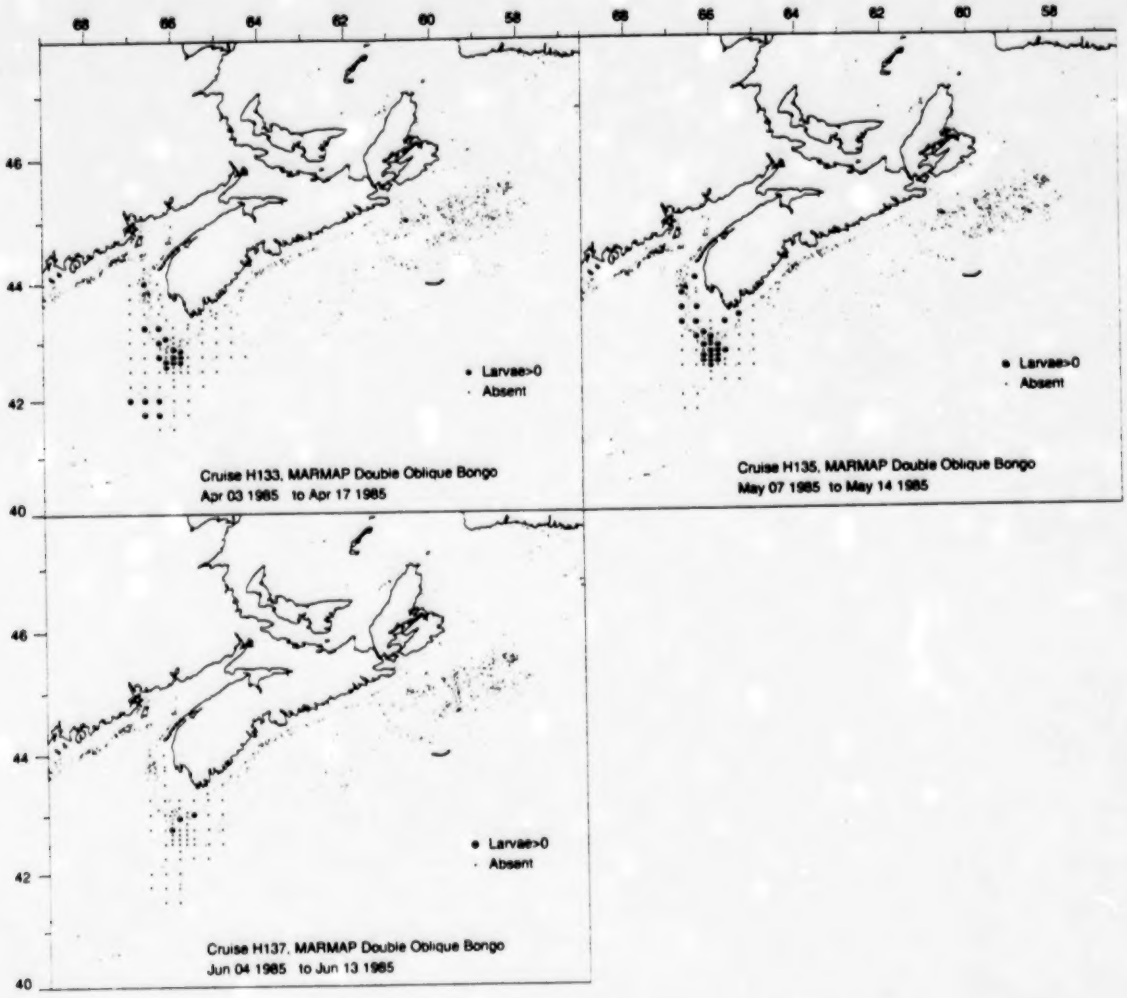

Fig. 8.3.6. (continued).

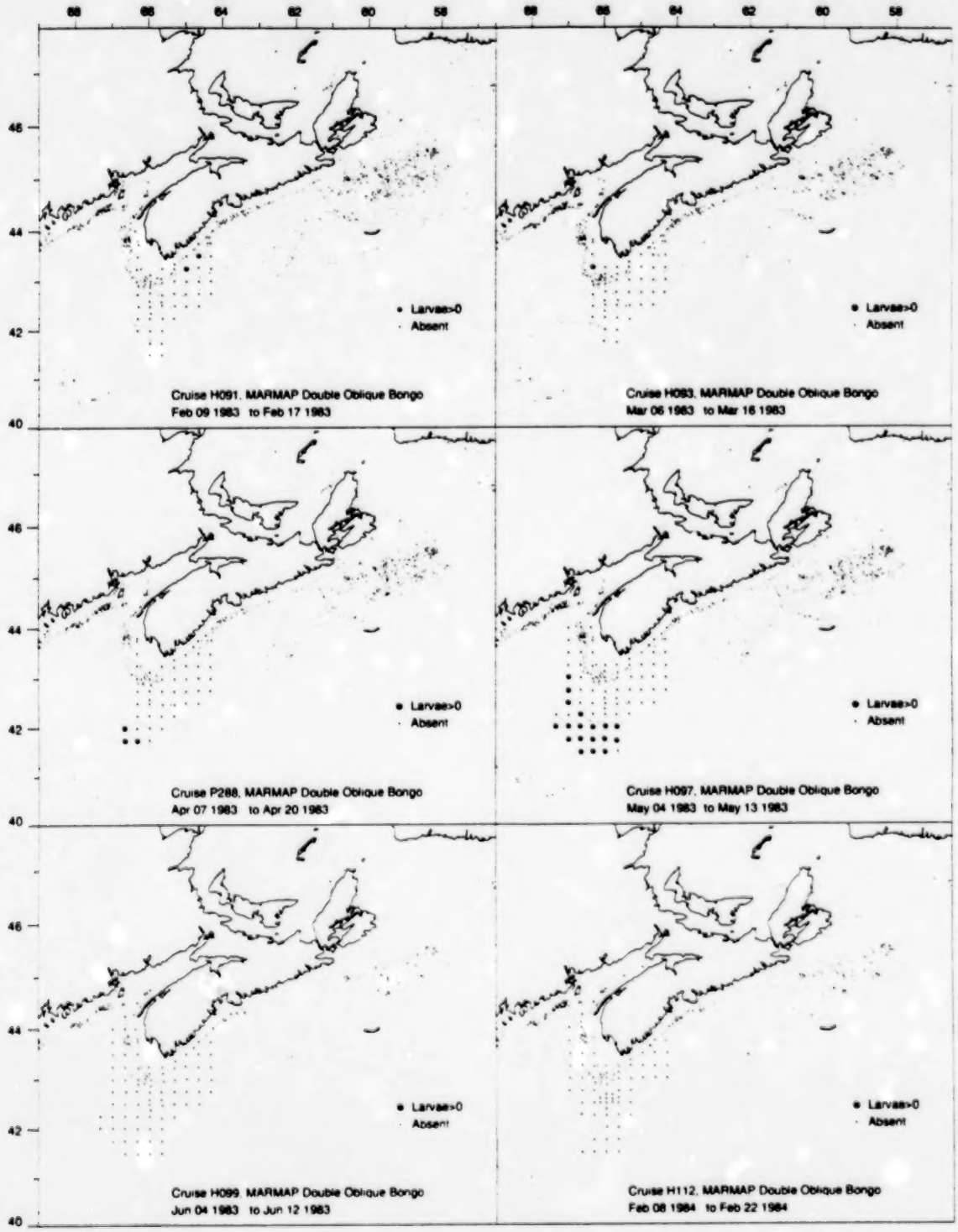
Larvae>0
Absent
Cruise H091, MARMAP Double Oblique Bongo
Feb 09 1983 to Feb 17 1983
Cruise H083, MARMAP Double Oblique Bongo
Mar 06 1983 to Mar 16 1983
Cruise P288, MARMAP Double Oblique Bongo
Apr 07 1983 to Apr 20 1983
Cruise H097, MARMAP Double Oblique Bongo
May 04 1983 to May 13 1983
Cruise H099, MARMAP Double Oblique Bongo
Jun 04 1983 to Jun 12 1983
Cruise H112, MARMAP Double Oblique Bongo
Feb 08 1984 to Feb 22 1984

Fig. 8.3.7. Fisheries Ecology Program Cruises: Cod larvae (7+mm).

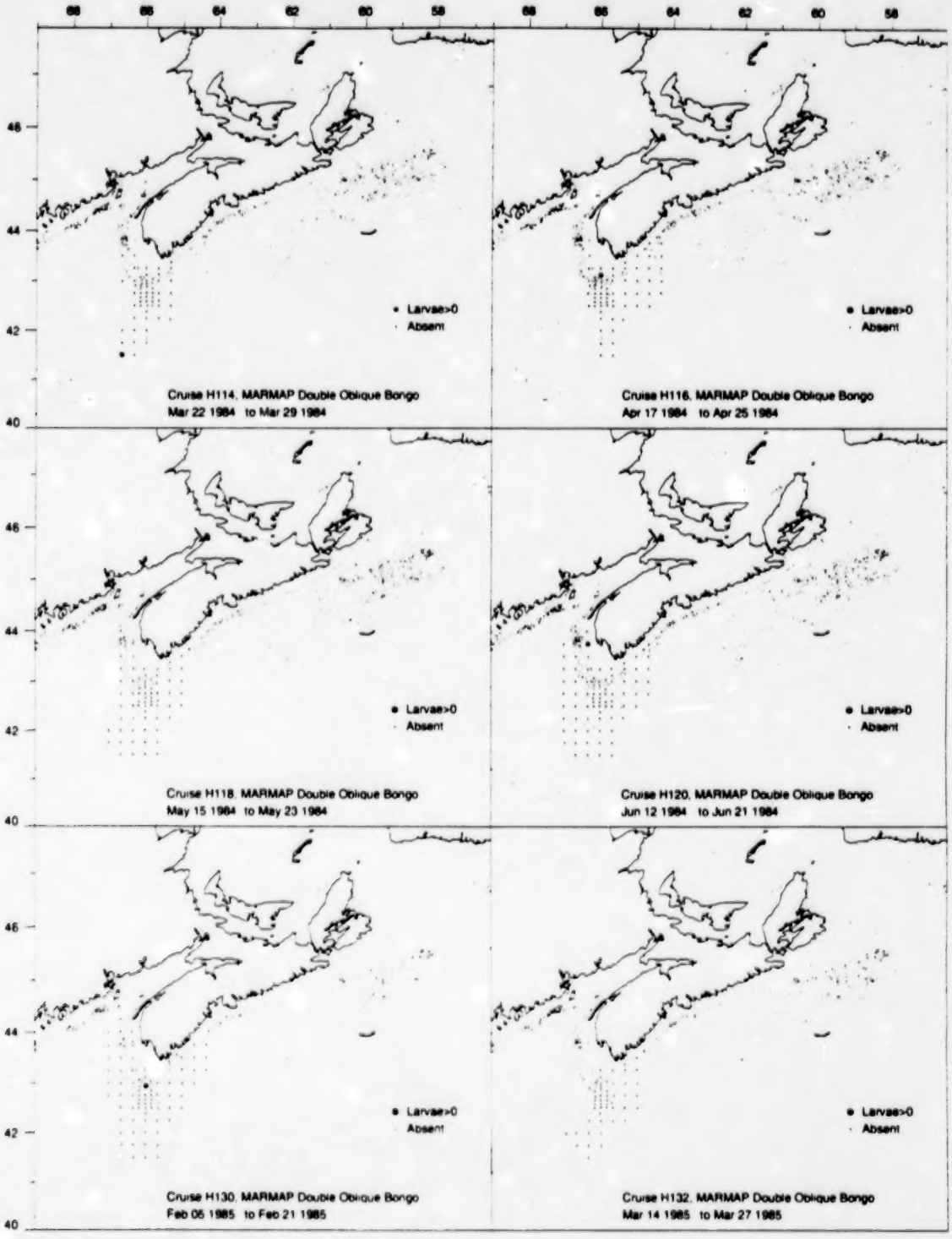

Fig. 8.3.7. (continued).

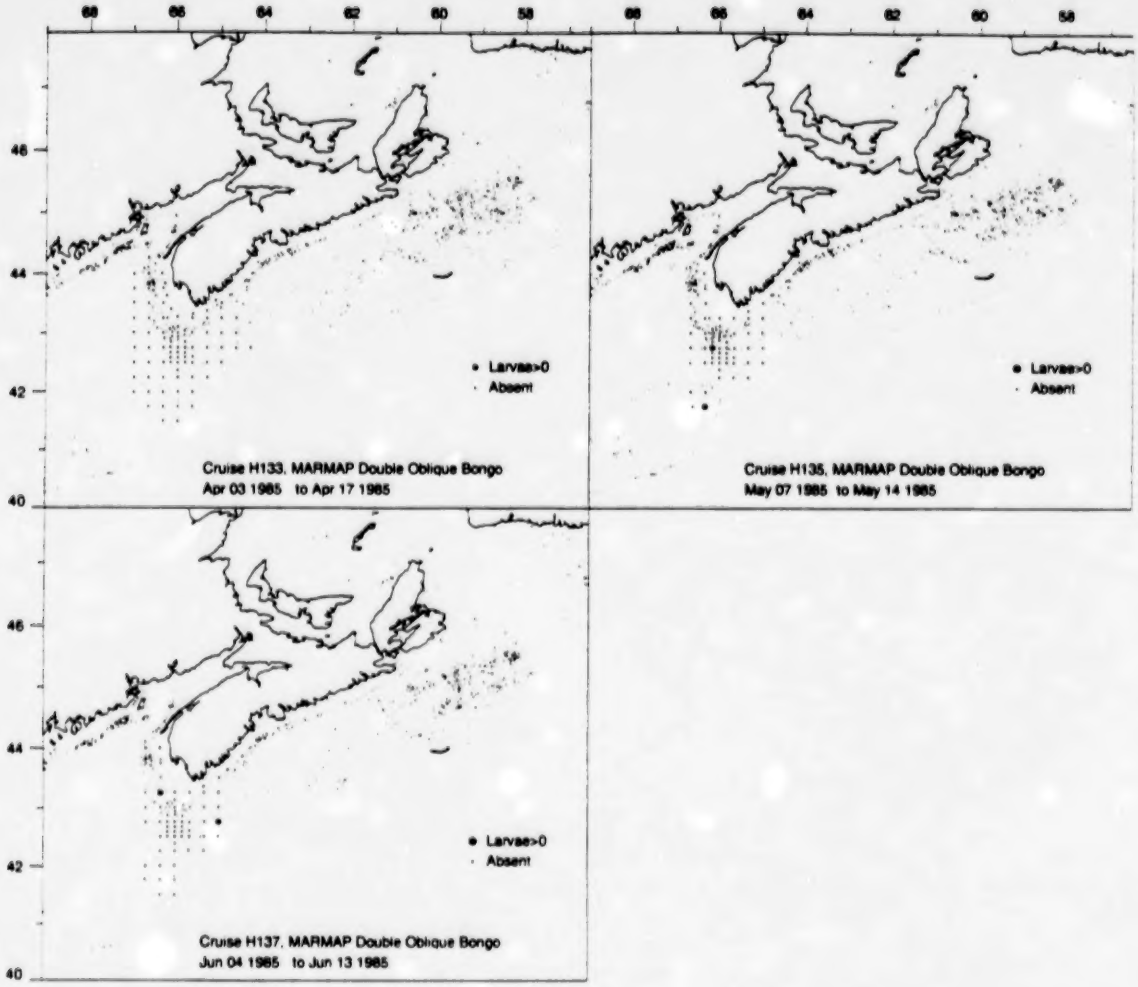

Fig. 8.3.7. (continued).

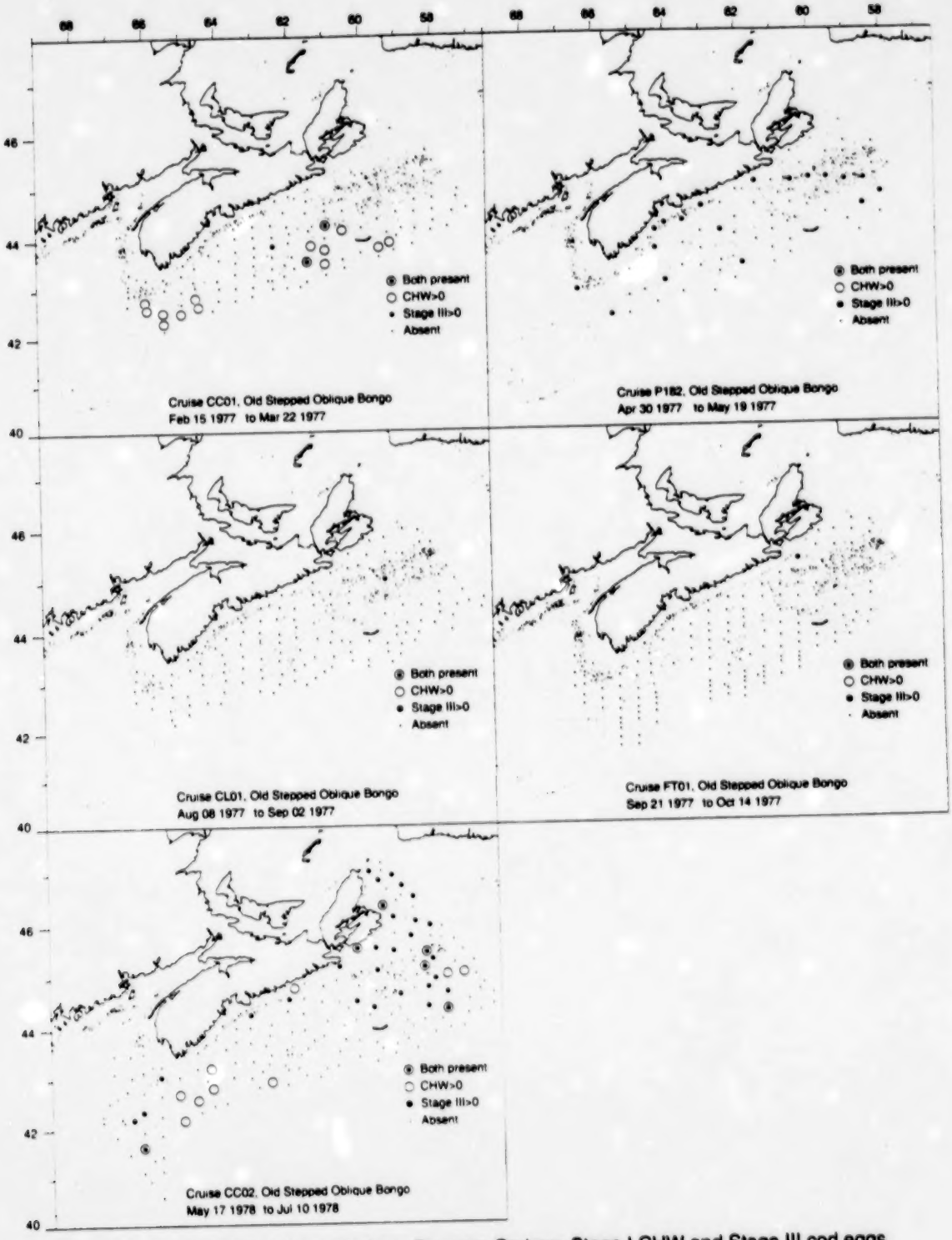
Both present
CHW>0
Stage III>0
Absent
Cruise CC01, Old Stepped Oblique Bongo
Feb 15 1977 to Mar 22 1977
Cruise P182, Old Stepped Oblique Bongo
Apr 30 1977 to May 19 1977
Cruise CL01, Old Stepped Oblique Bongo
Aug 08 1977 to Sep 02 1977
Cruise FT01, Old Stepped Oblique Bongo
Sep 21 1977 to Oct 14 1977
Cruise CC02, Old Stepped Oblique Bongo
May 17 1978 to Jul 10 1978

Fig. 8.4.1. Scotian Shelf Ichthyoplankton Program Cruises: Stage I CHW and Stage III cod eggs.

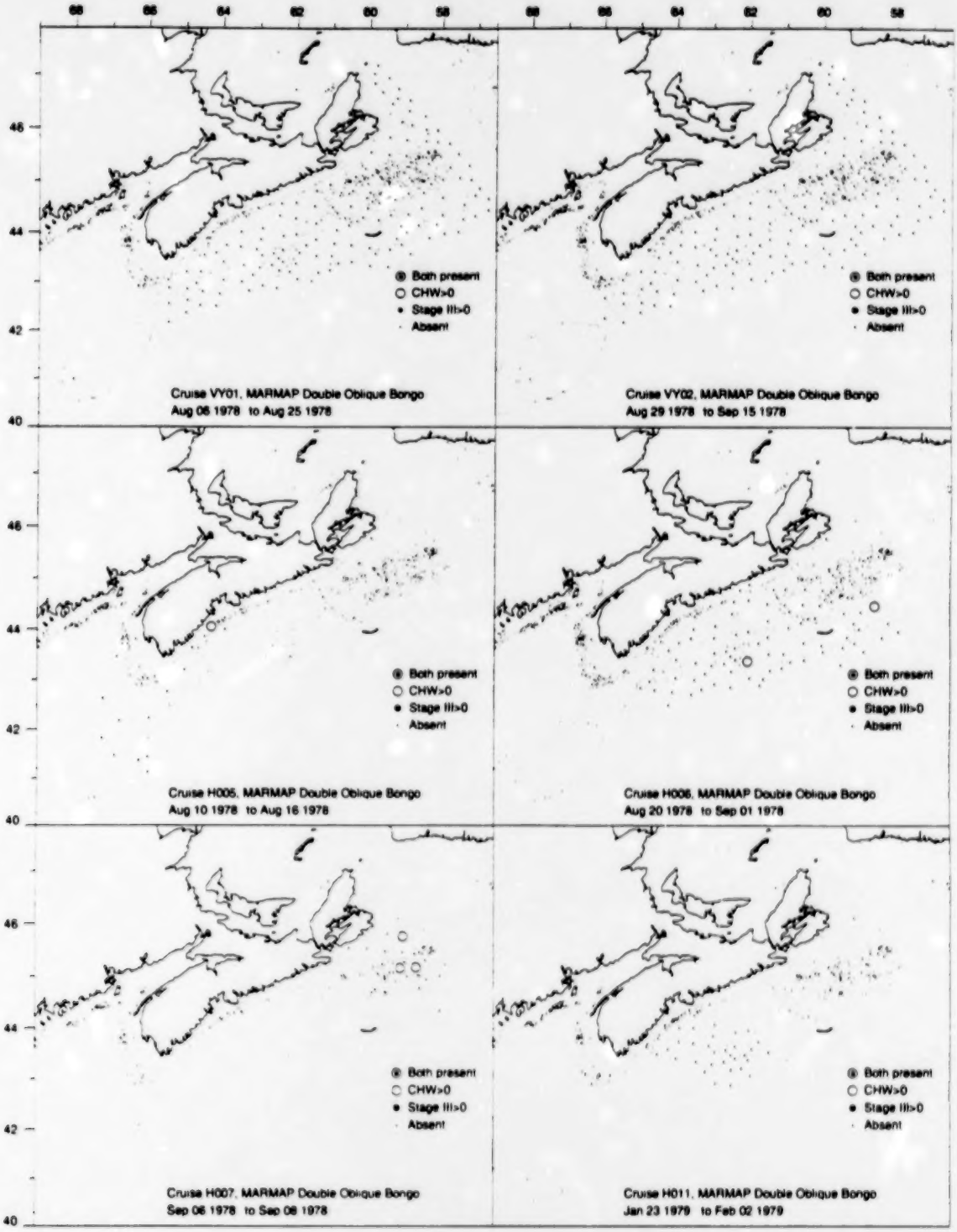
Both present
CHW>0
Stage III>0
Absent
Cruise VY01, MARMAP Double Oblique Bongo
Aug 06 1978 to Aug 25 1978
Cruise VY02, MARMAP Double Oblique Bongo
Aug 29 1978 to Sep 15 1978
Cruise H005, MARMAP Double Oblique Bongo
Aug 10 1978 to Aug 16 1978
Cruise H006, MARMAP Double Oblique Bongo
Aug 20 1978 to Sep 01 1978
Cruise H007, MARMAP Double Oblique Bongo
Sep 06 1978 to Sep 08 1978
Cruise H011, MARMAP Double Oblique Bongo
Jan 23 1979 to Feb 02 1979

Fig. 8.4.1. (continued).

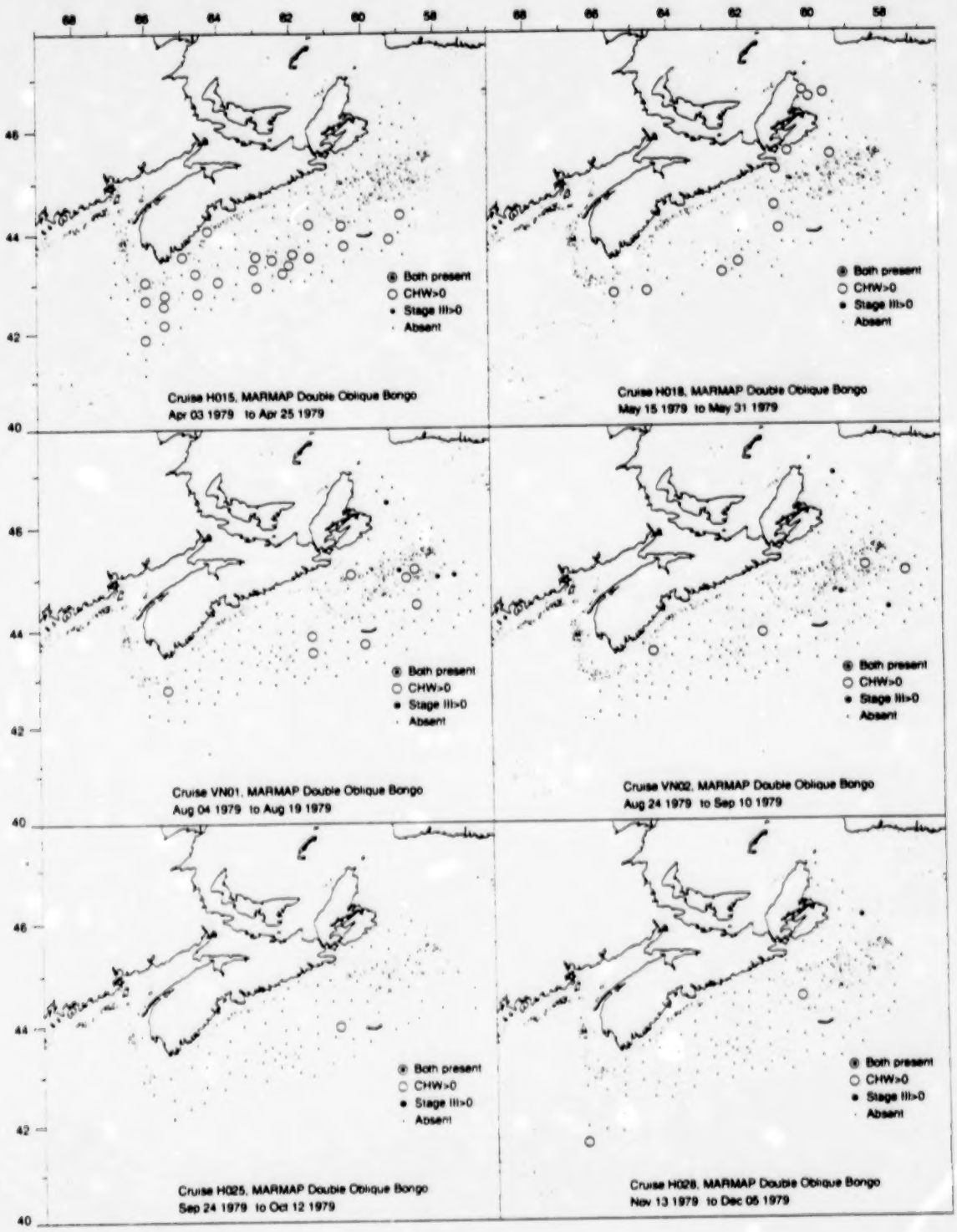
Both present
CHW>0
Stage III>0
Absent
Cruise H015, MARMAP Double Oblique Bongo
Apr 03 1979 to Apr 25 1979
Cruise H018, MARMAP Double Oblique Bongo
May 15 1979 to May 31 1979
Cruise VN01, MARMAP Double Oblique Bongo
Aug 04 1979 to Aug 19 1979
Cruise VN02, MARMAP Double Oblique Bongo
Aug 24 1979 to Sep 10 1979
Cruise H025, MARMAP Double Oblique Bongo
Sep 24 1979 to Oct 12 1979
Cruise H028, MARMAP Double Oblique Bongo
Nov 13 1979 to Dec 05 1979

Fig. 8.4.1. (continued).

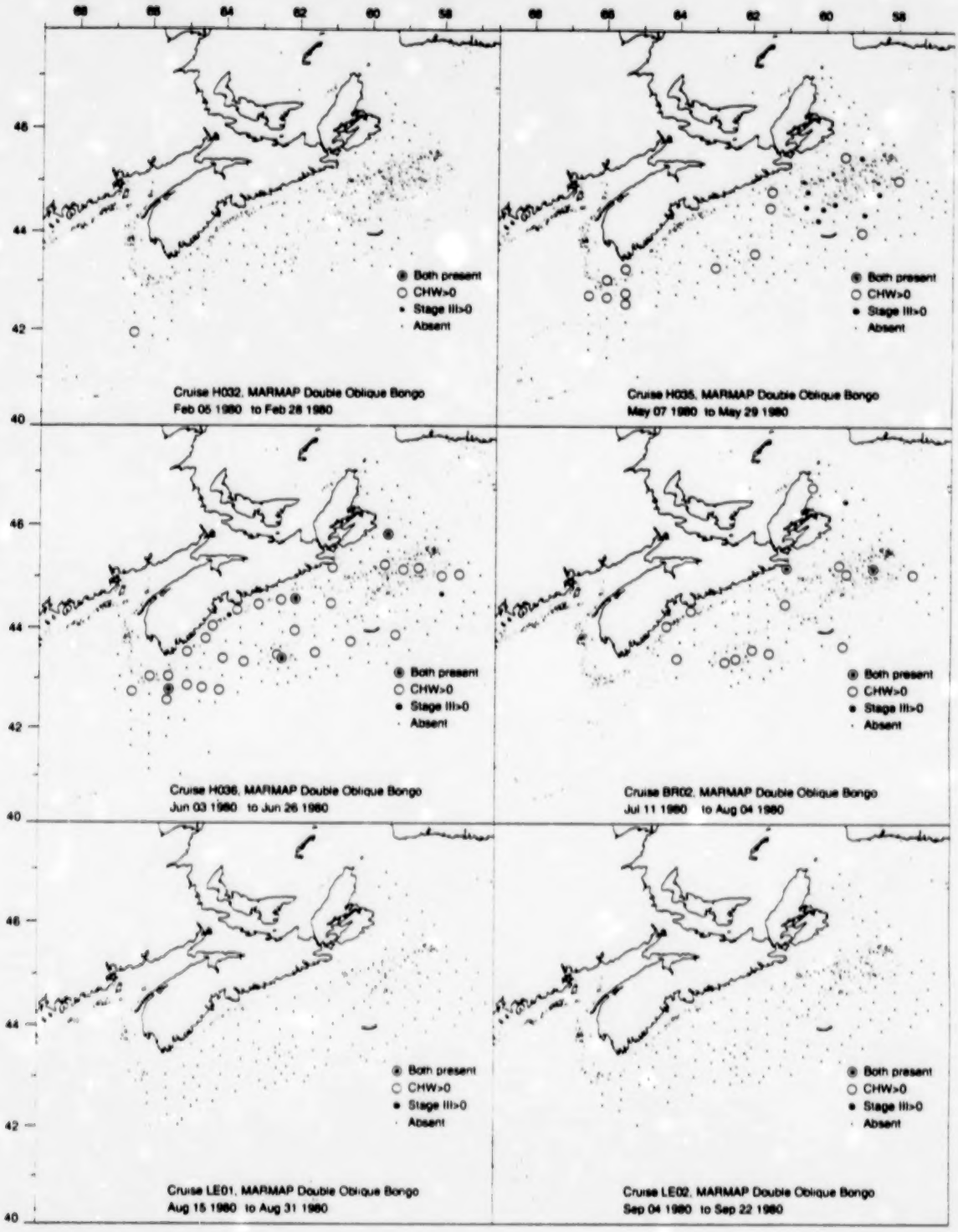
Both present
CHW>0
Stage III>0
Absent
Cruise H032, MARMAP Double Oblique Bongo
Feb 05 1980 to Feb 28 1980
Cruise H035, MARMAP Double Oblique Bongo
May 07 1980 to May 29 1980
Cruise H036, MARMAP Double Oblique Bongo
Jun 03 1980 to Jun 26 1980
Cruise BR02, MARMAP Double Oblique Bongo
Jul 11 1980 to Aug 04 1980
Cruise LE01, MARMAP Double Oblique Bongo
Aug 15 1980 to Aug 31 1980
Cruise LE02, MARMAP Double Oblique Bongo
Sep 04 1980 to Sep 22 1980

Fig. 8.4.1. (continued).

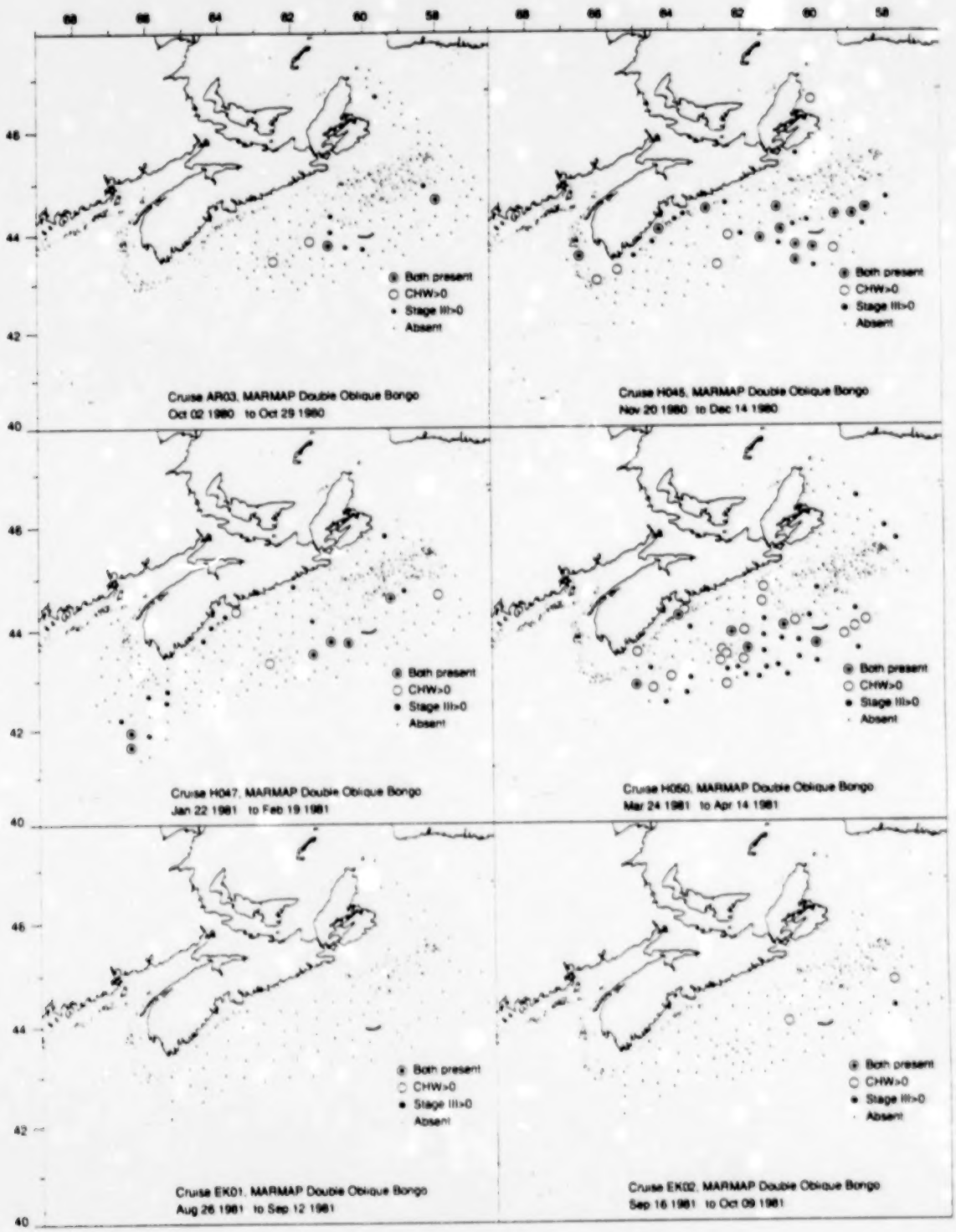
Both present
CHW>0
Stage III>0
Absent
Cruise AR03. MARMAP Double Oblique Bongo
Oct 02 1980 to Oct 29 1980
Cruise H045. MARMAP Double Oblique Bongo
Nov 20 1980 to Dec 14 1980
Cruise H047. MARMAP Double Oblique Bongo
Jan 22 1981 to Feb 19 1981
Cruise H050. MARMAP Double Oblique Bongo
Mar 24 1981 to Apr 14 1981
Cruise EK01. MARMAP Double Oblique Bongo
Aug 26 1981 to Sep 12 1981
Cruise EK02. MARMAP Double Oblique Bongo
Sep 16 1981 to Oct 09 1981

Fig. 8.4.1. (continued).

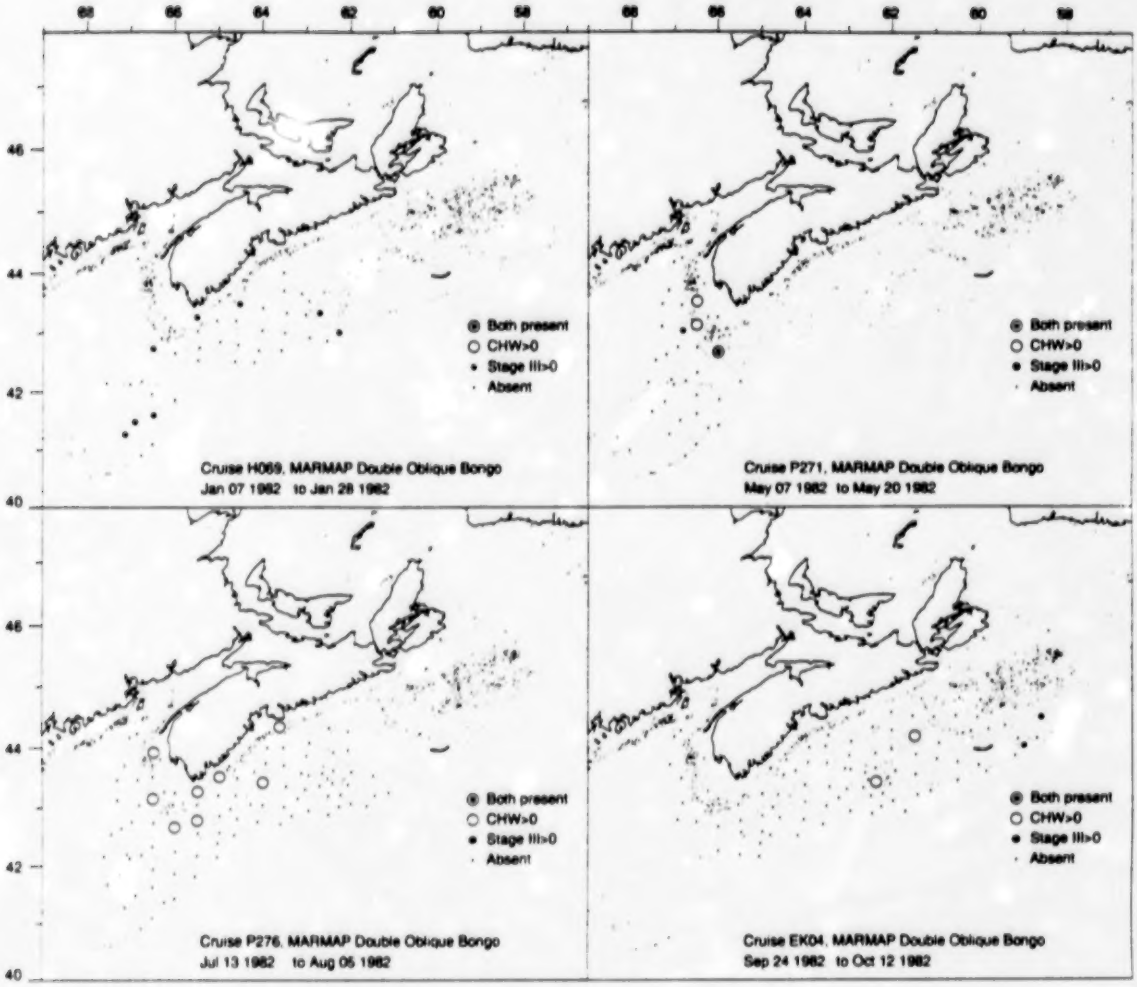

Fig. 8.4.1. (continued).

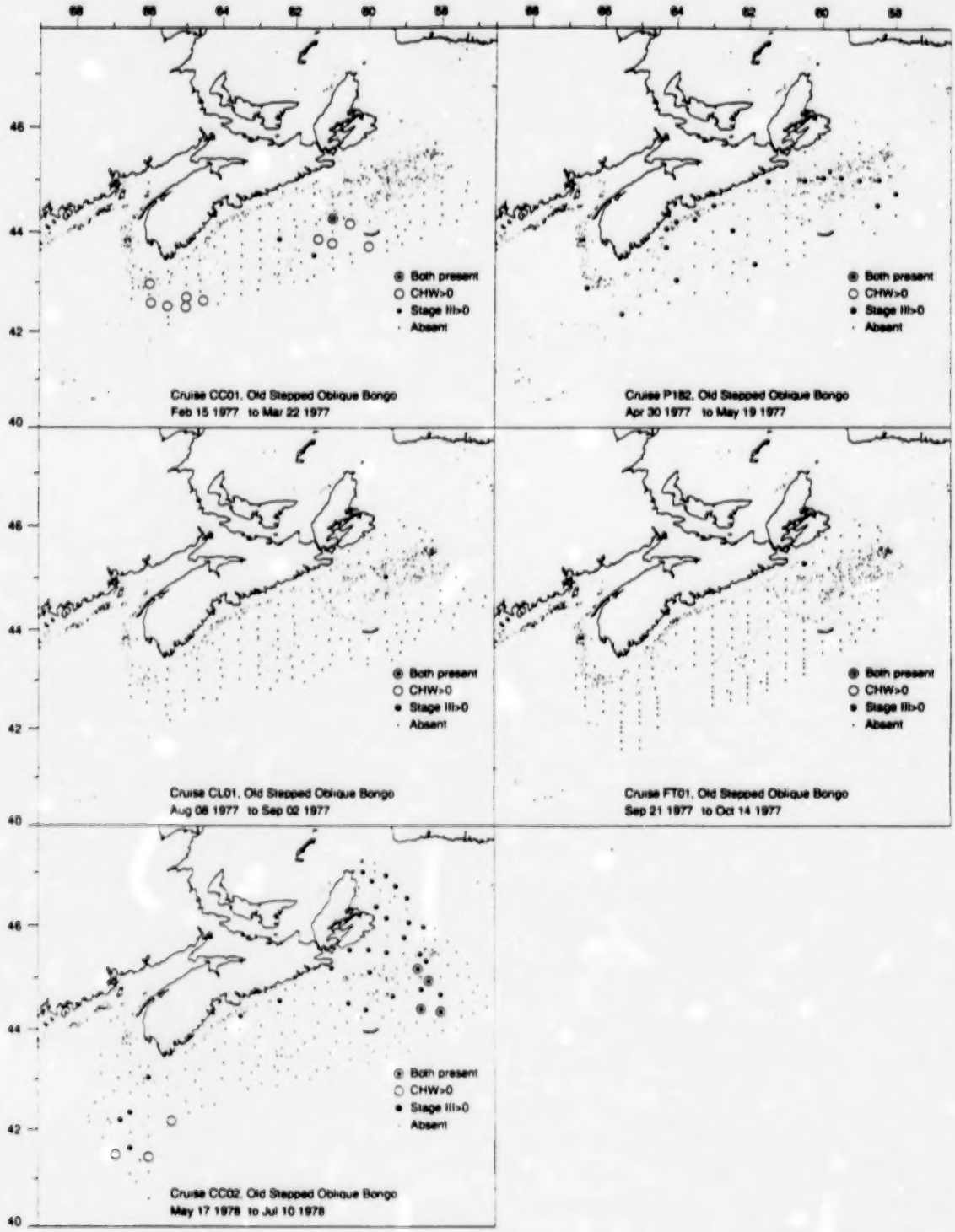
Both present
CHW>0
Stage III>0
Absent
Cruise CC01, Old Stepped Oblique Bongo
Feb 15 1977 to Mar 22 1977
Cruise P182, Old Stepped Oblique Bongo
Apr 30 1977 to May 19 1977
Cruise CL01, Old Stepped Oblique Bongo
Aug 08 1977 to Sep 02 1977
Cruise FT01, Old Stepped Oblique Bongo
Sep 21 1977 to Oct 14 1977
Cruise CC02, Old Stepped Oblique Bongo
May 17 1978 to Jul 10 1978

Fig. 8.4.2. Scotian Shelf Ichthyoplankton Program Cruises: Stage II CHW and Stage III cod eggs.

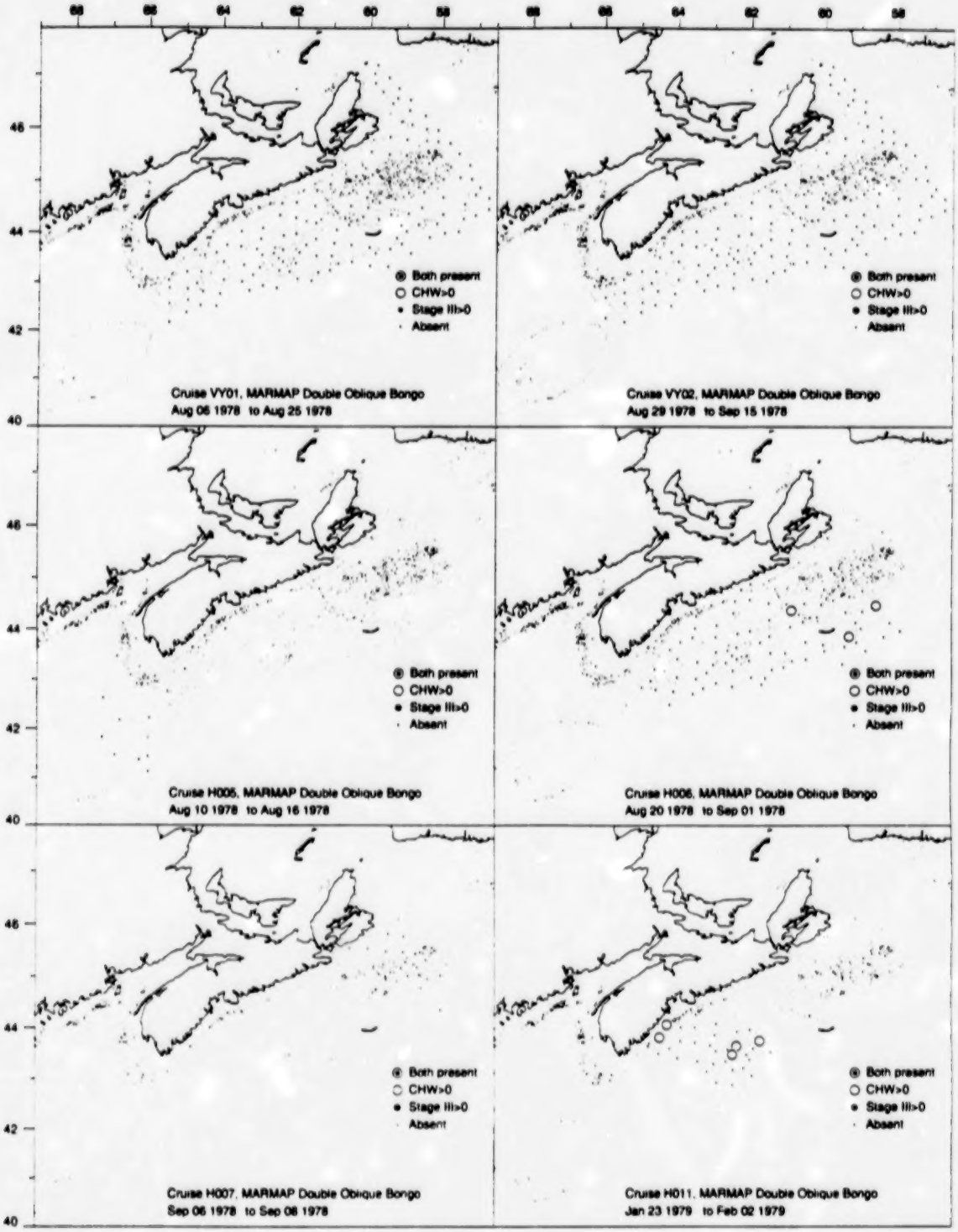
Both present
CHW>0
Stage III>0
Absent
Cruise VY01, MARMAP Double Oblique Bongo
Aug 06 1978 to Aug 25 1978
Cruise VY02, MARMAP Double Oblique Bongo
Aug 29 1978 to Sep 15 1978
Cruise H005, MARMAP Double Oblique Bongo
Aug 10 1978 to Aug 16 1978
Cruise H006, MARMAP Double Oblique Bongo
Aug 20 1978 to Sep 01 1978
Cruise H007, MARMAP Double Oblique Bongo
Sep 06 1978 to Sep 08 1978
Cruise H011, MARMAP Double Oblique Bongo
Jan 23 1979 to Feb 02 1979

Fig. 8.4.2. (continued).

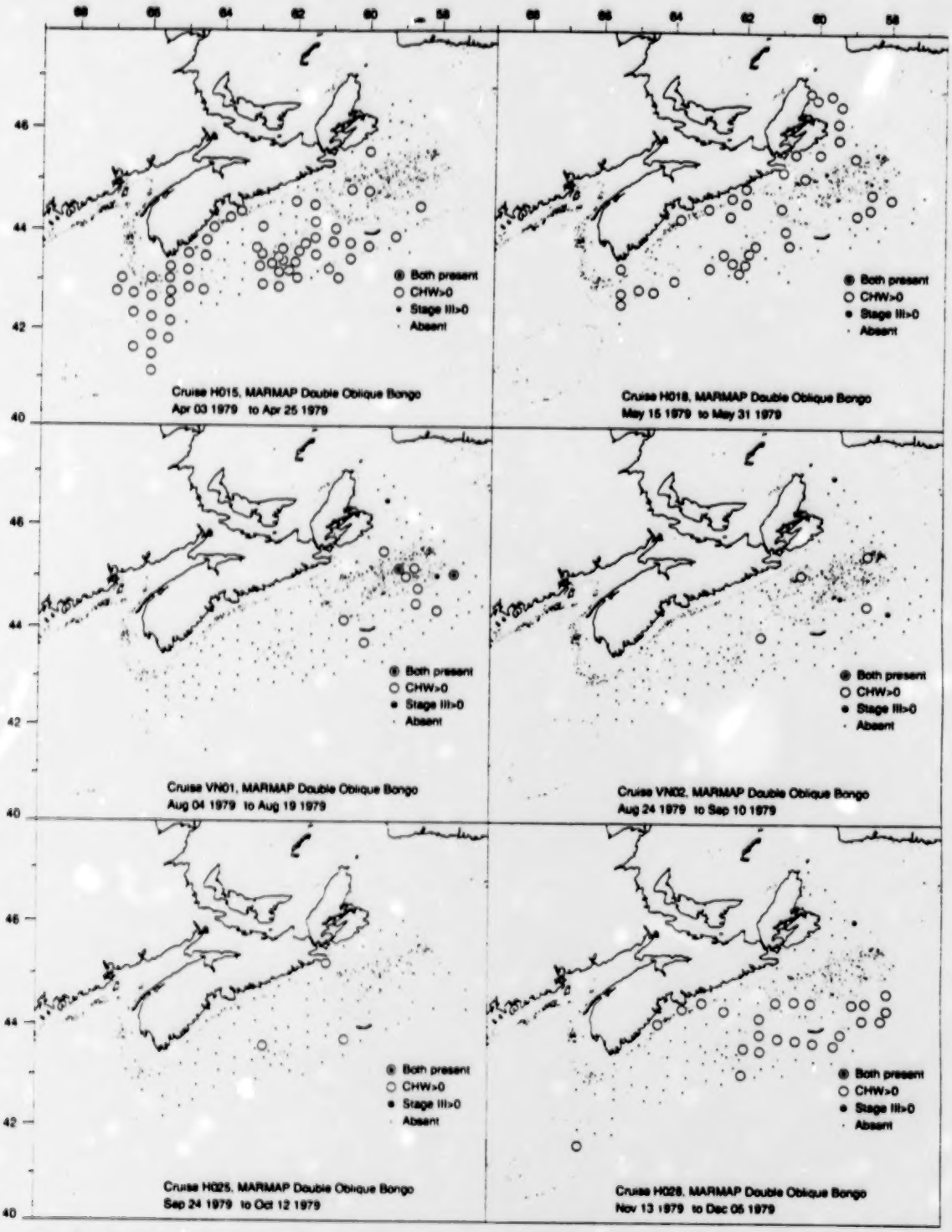
Both present
CHW>0
Stage III>0
Absent
Cruise H015, MARMAP Double Oblique Bongo
Apr 03 1979 to Apr 25 1979
Cruise H018, MARMAP Double Oblique Bongo
May 15 1979 to May 31 1979
Cruise VN01, MARMAP Double Oblique Bongo
Aug 04 1979 to Aug 19 1979
Cruise VN02, MARMAP Double Oblique Bongo
Aug 24 1979 to Sep 10 1979
Cruise H025, MARMAP Double Oblique Bongo
Sep 24 1979 to Oct 12 1979
Cruise H026, MARMAP Double Oblique Bongo
Nov 13 1979 to Dec 05 1979

Fig. 8.4.2. (continued).

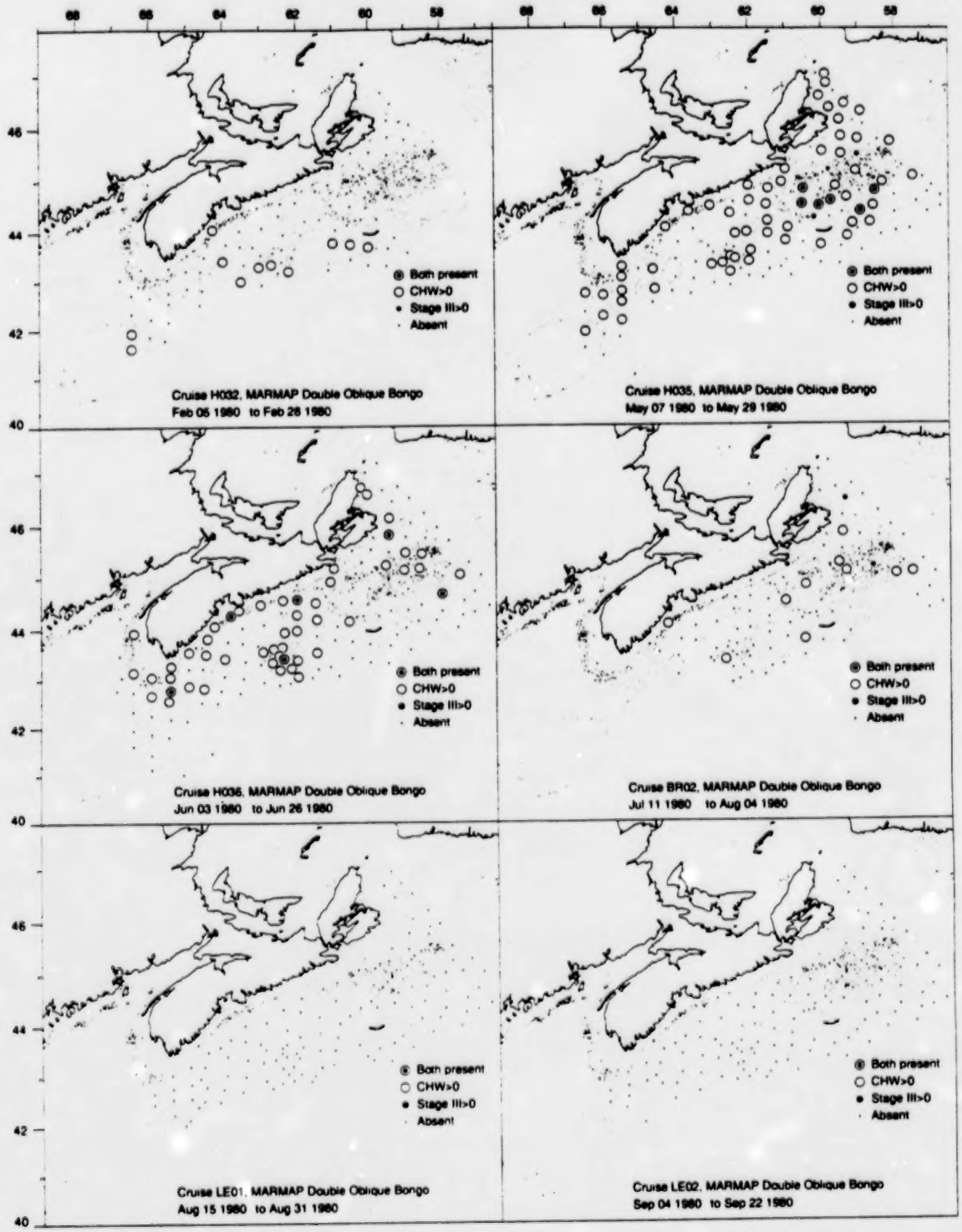
Both present
CHW>0
Stage III>0
Absent
Cruise H032, MARMAP Double Oblique Bongo
Feb 05 1980 to Feb 28 1980
Cruise H035, MARMAP Double Oblique Bongo
May 07 1980 to May 29 1980
Cruise H036, MARMAP Double Oblique Bongo
Jun 03 1980 to Jun 26 1980
Cruise BR02, MARMAP Double Oblique Bongo
Jul 11 1980 to Aug 04 1980
Cruise LE01, MARMAP Double Oblique Bongo
Aug 15 1980 to Aug 31 1980
Cruise LE02, MARMAP Double Oblique Bongo
Sep 04 1980 to Sep 22 1980

Fig. 8.4.2. (continued).

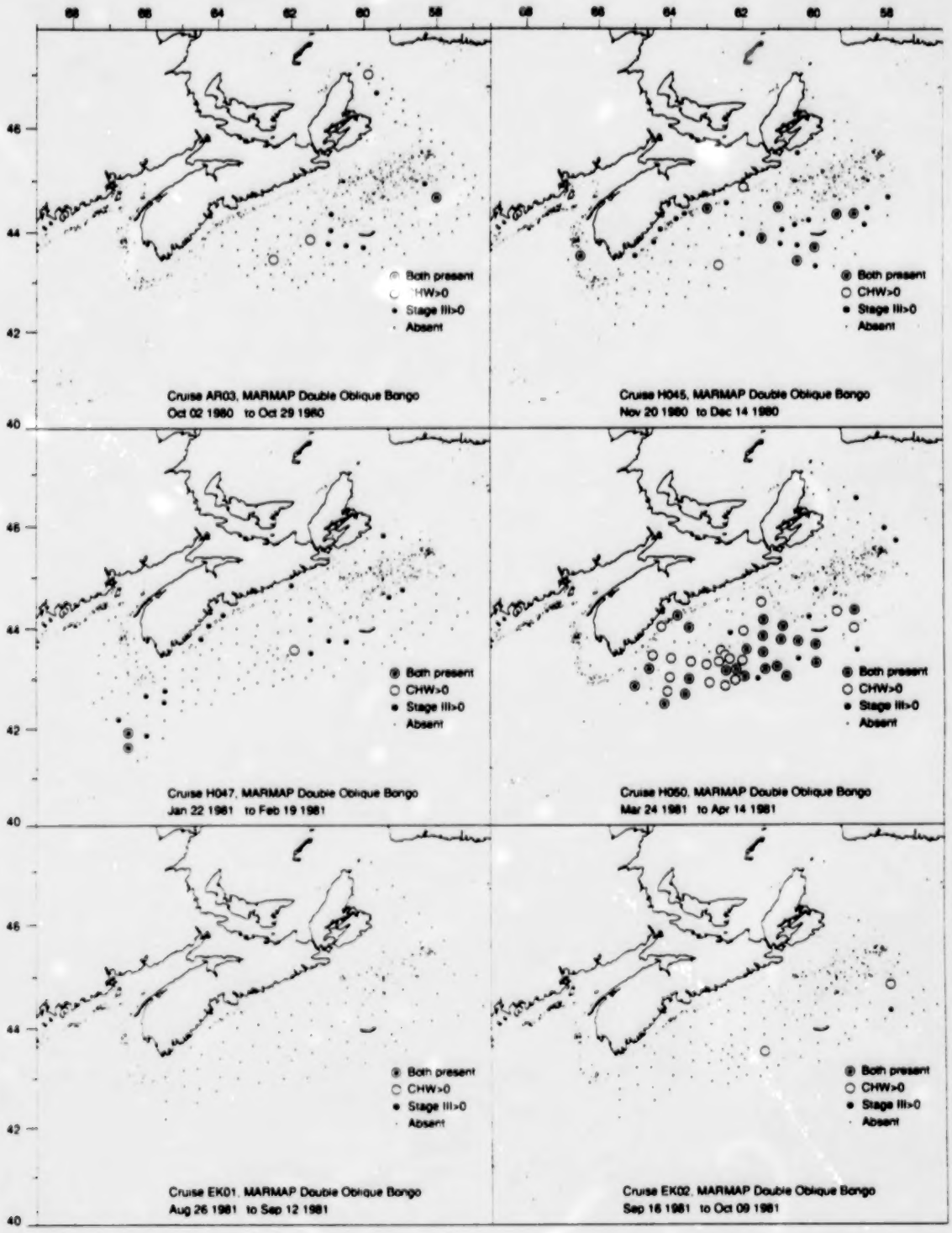

Fig. 8.4.2. (continued).

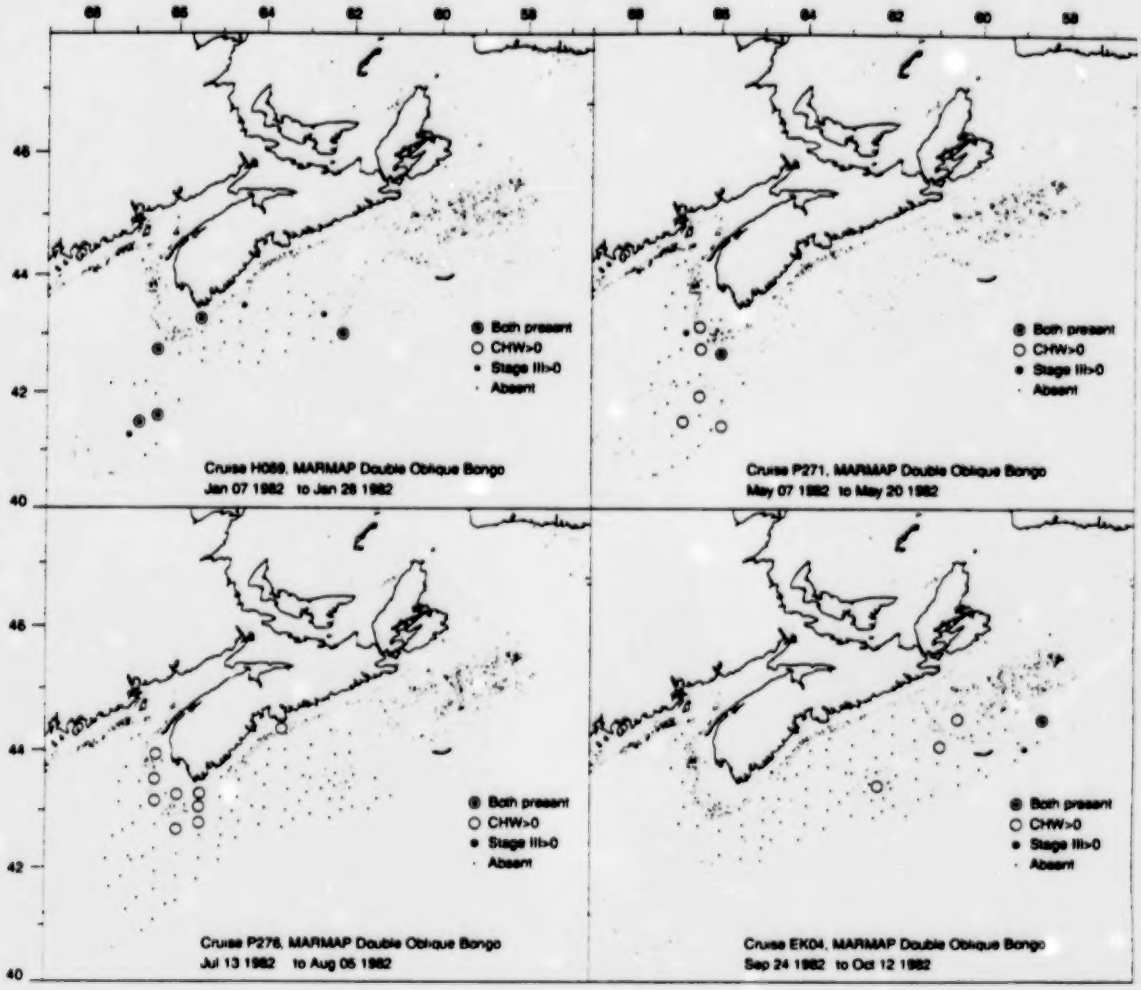
Both present
CHW>0
Stage III>0
Absent
Cruise H089, MARMAP Double Oblique Bongo
Jan 07 1982 to Jan 28 1982
Cruise P271, MARMAP Double Oblique Bongo
May 07 1982 to May 20 1982
Cruise P276, MARMAP Double Oblique Bongo
Jul 13 1982 to Aug 05 1982
Cruise EK04, MARMAP Double Oblique Bongo
Sep 24 1982 to Oct 12 1982

Fig. 8.4.2. (continued).

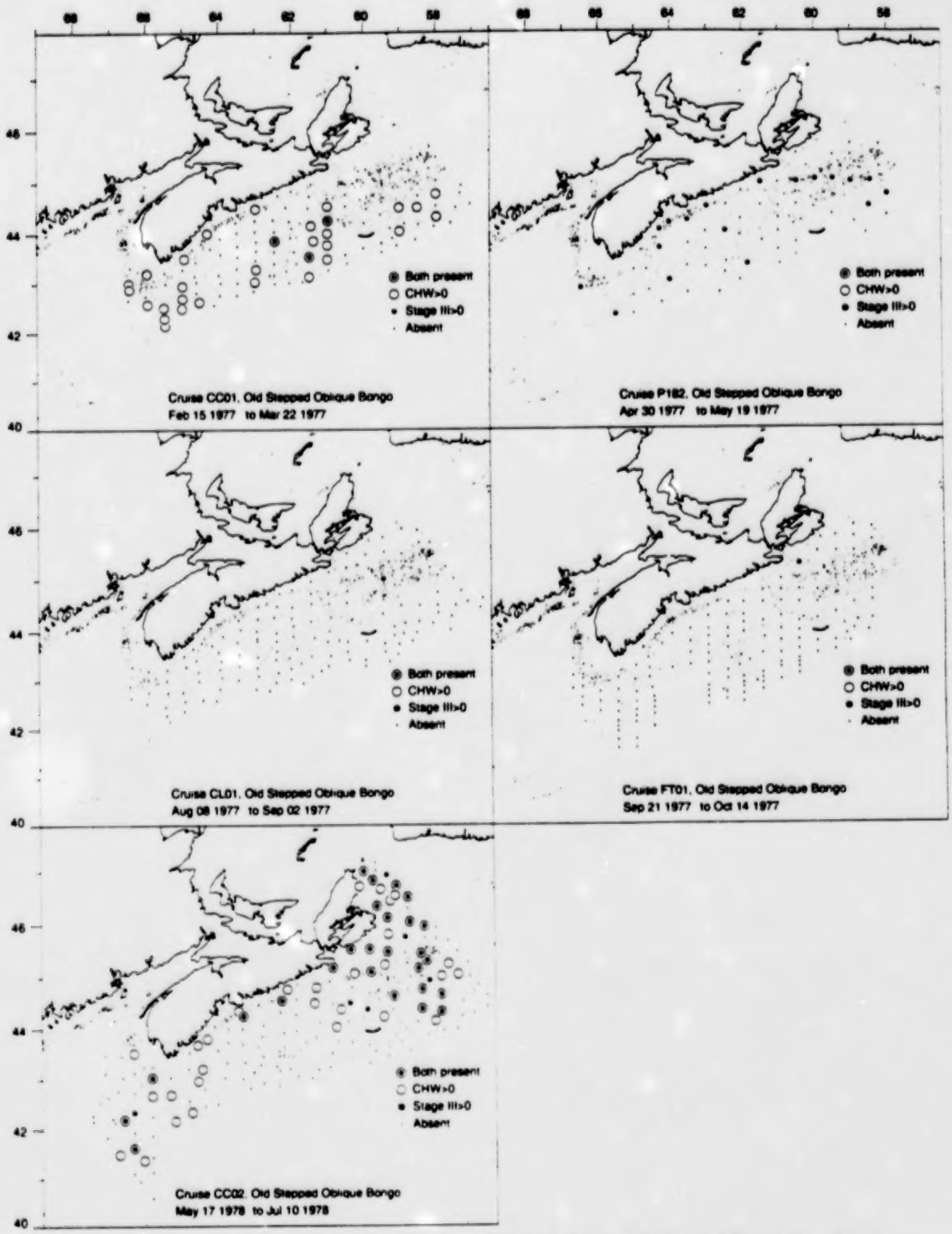
Both present
CHW>0
Stage III>0
Absent
Cruise CC01. Old Stepped Oblique Bongo
Feb 15 1977 to Mar 22 1977
Cruise P182. Old Stepped Oblique Bongo
Apr 30 1977 to May 19 1977
Cruise CL01. Old Stepped Oblique Bongo
Aug 08 1977 to Sep 02 1977
Cruise FT01. Old Stepped Oblique Bongo
Sep 21 1977 to Oct 14 1977
Cruise CC02. Old Stepped Oblique Bongo
May 17 1978 to Jul 10 1978

Fig. 8.4.3. Scotian Shelf Ichthyoplankton Program Cruises: Stage III CHW and Stage III cod eggs.

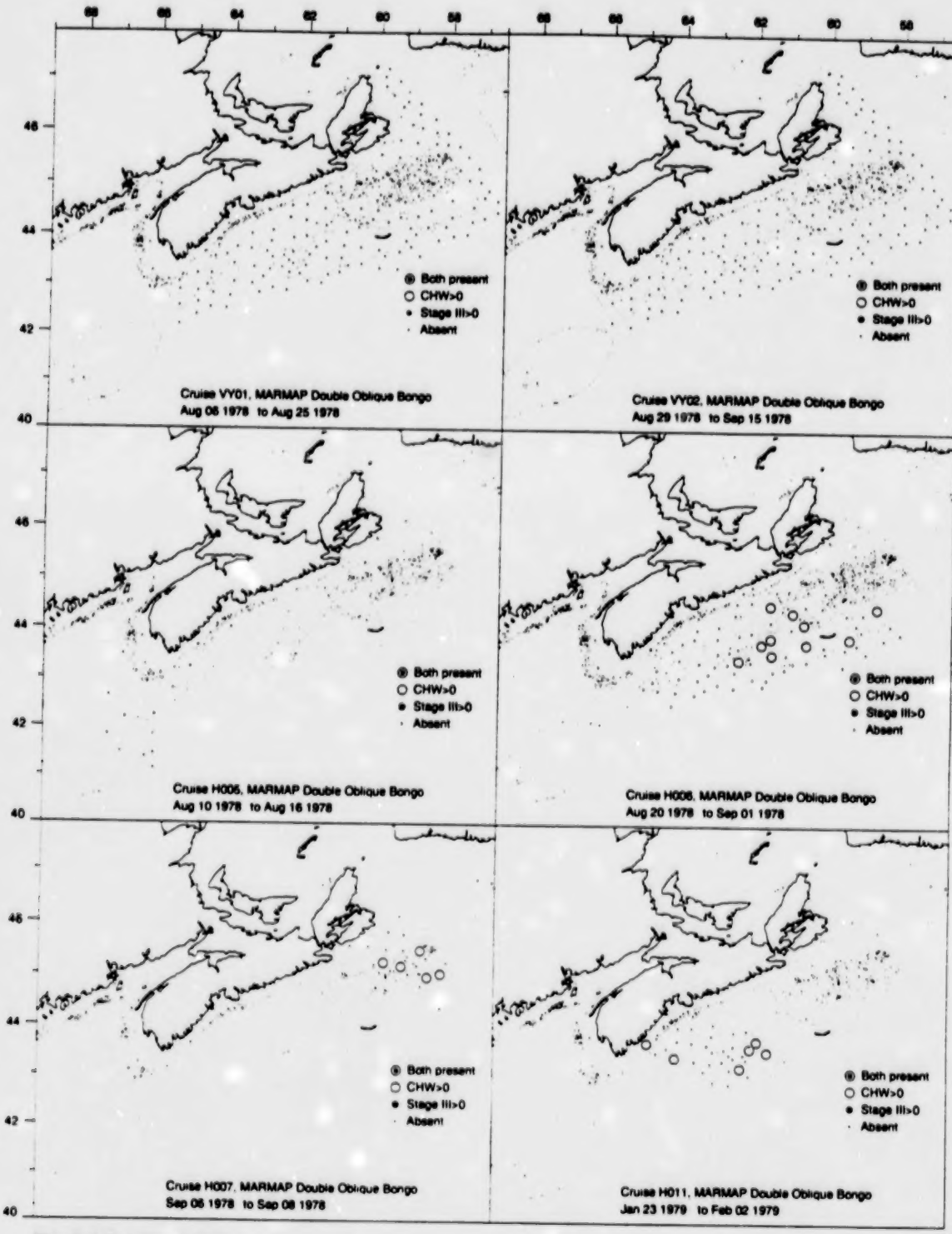
Both present
CHW>0
Stage III>0
Absent
Cruise VY01, MARMAP Double Oblique Bongo
Aug 08 1978 to Aug 25 1978
Cruise VY02, MARMAP Double Oblique Bongo
Aug 29 1978 to Sep 15 1978
Cruise H005, MARMAP Double Oblique Bongo
Aug 10 1978 to Aug 16 1978
Cruise H006, MARMAP Double Oblique Bongo
Aug 20 1978 to Sep 01 1978
Cruise H007, MARMAP Double Oblique Bongo
Sep 06 1978 to Sep 08 1978
Cruise H011, MARMAP Double Oblique Bongo
Jan 23 1979 to Feb 02 1979

Fig. 8.4.3. (continued).

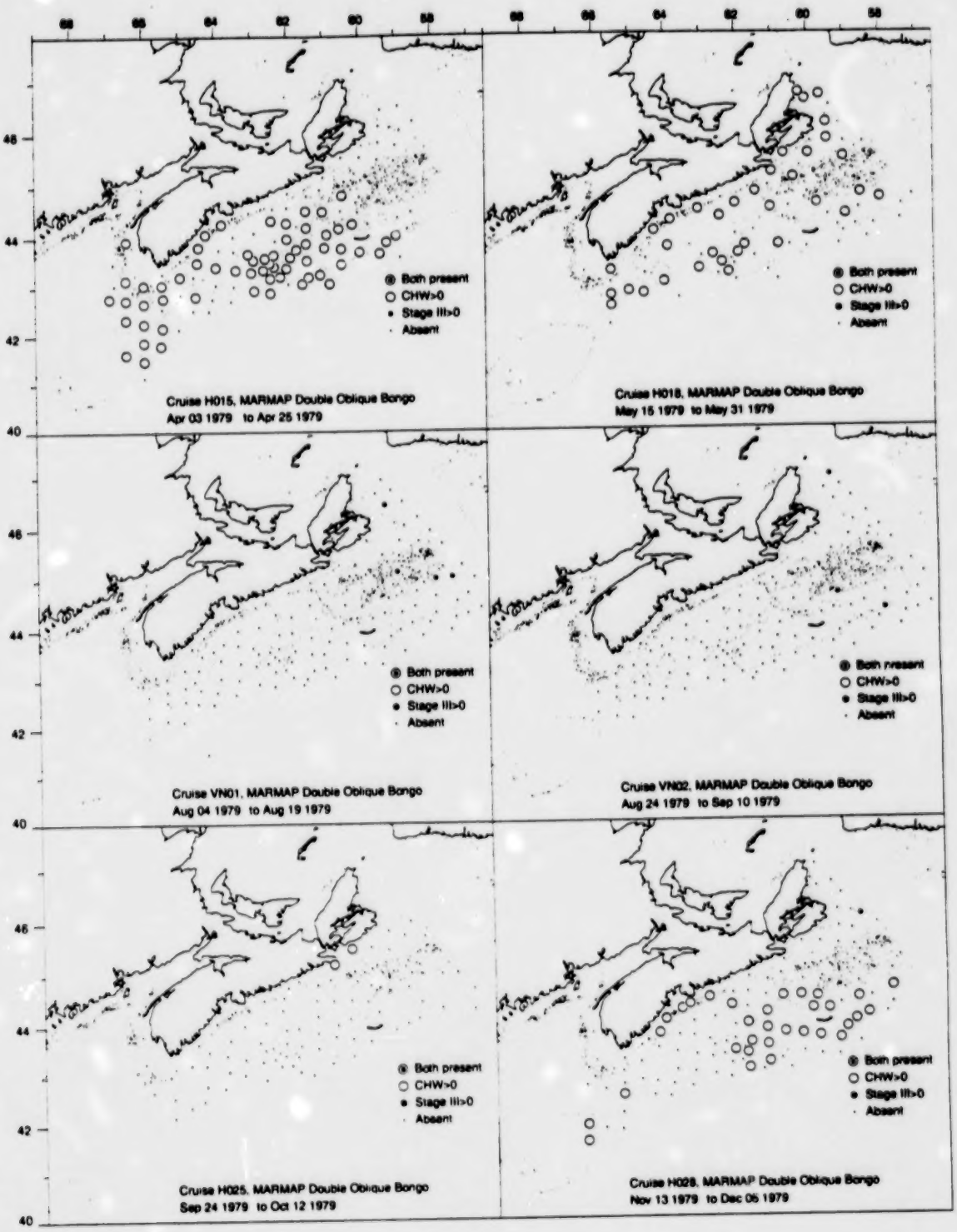
Both present
CHW>0
Stage III>0
Absent
Cruise H015, MARMAP Double Oblique Bongo
Apr 03 1979 to Apr 25 1979
Cruise H018, MARMAP Double Oblique Bongo
May 15 1979 to May 31 1979
Cruise VN01, MARMAP Double Oblique Bongo
Aug 04 1979 to Aug 19 1979
Cruise VN02, MARMAP Double Oblique Bongo
Aug 24 1979 to Sep 10 1979
Cruise H025, MARMAP Double Oblique Bongo
Sep 24 1979 to Oct 12 1979
Cruise H028, MARMAP Double Oblique Bongo
Nov 13 1979 to Dec 05 1979

Fig. 8.4.3. (continued).

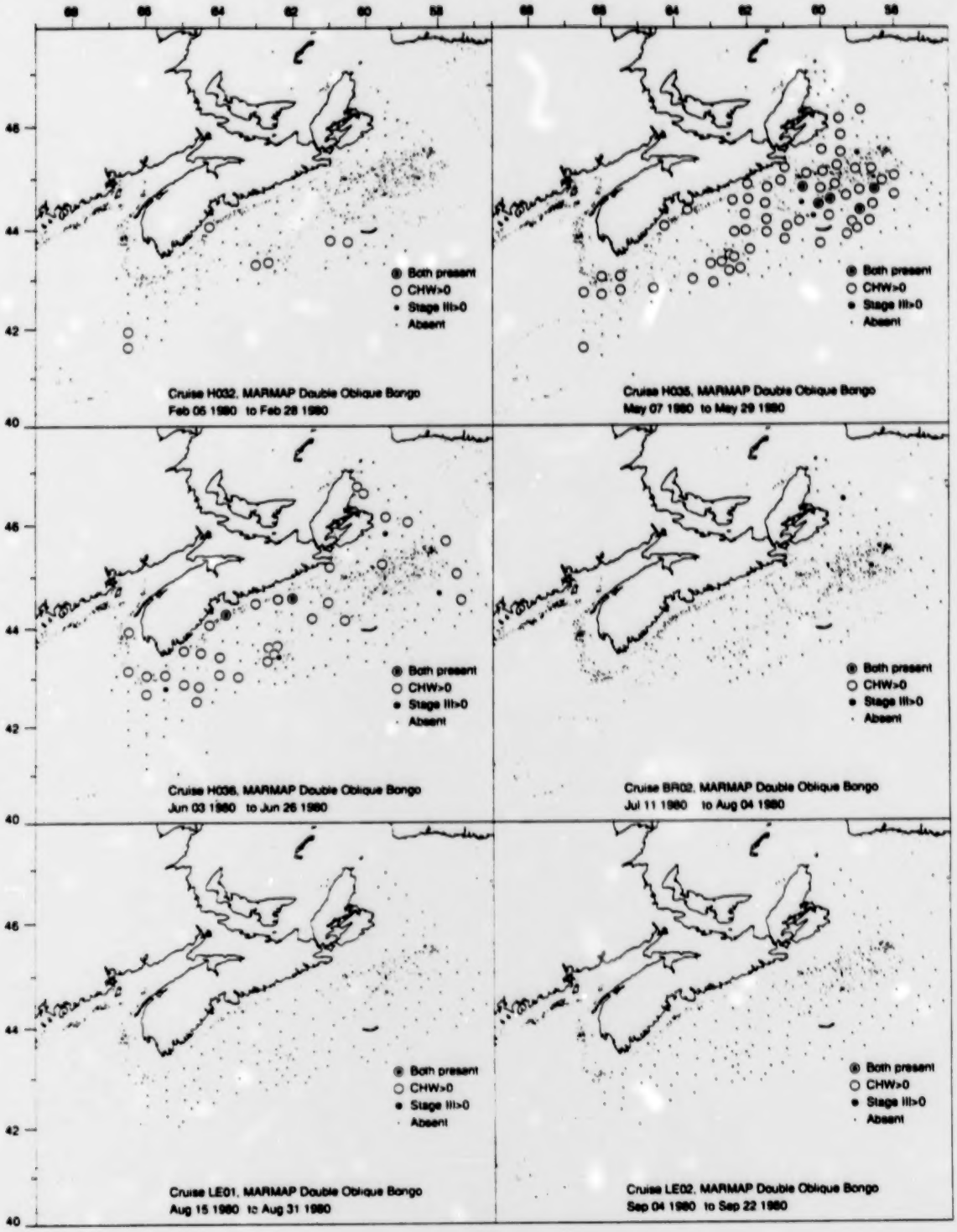
Both present
CHW>0
Stage III>0
Absent
Cruise H032, MARMAP Double Oblique Bongo
Feb 05 1980 to Feb 28 1980
Cruise H035, MARMAP Double Oblique Bongo
May 07 1980 to May 29 1980
Cruise H036, MARMAP Double Oblique Bongo
Jun 03 1980 to Jun 26 1980
Cruise BR02, MARMAP Double Oblique Bongo
Jul 11 1980 to Aug 04 1980
Cruise LE01, MARMAP Double Oblique Bongo
Aug 15 1980 to Aug 31 1980
Cruise LE02, MARMAP Double Oblique Bongo
Sep 04 1980 to Sep 22 1980

Fig. 8.4.3. (continued).

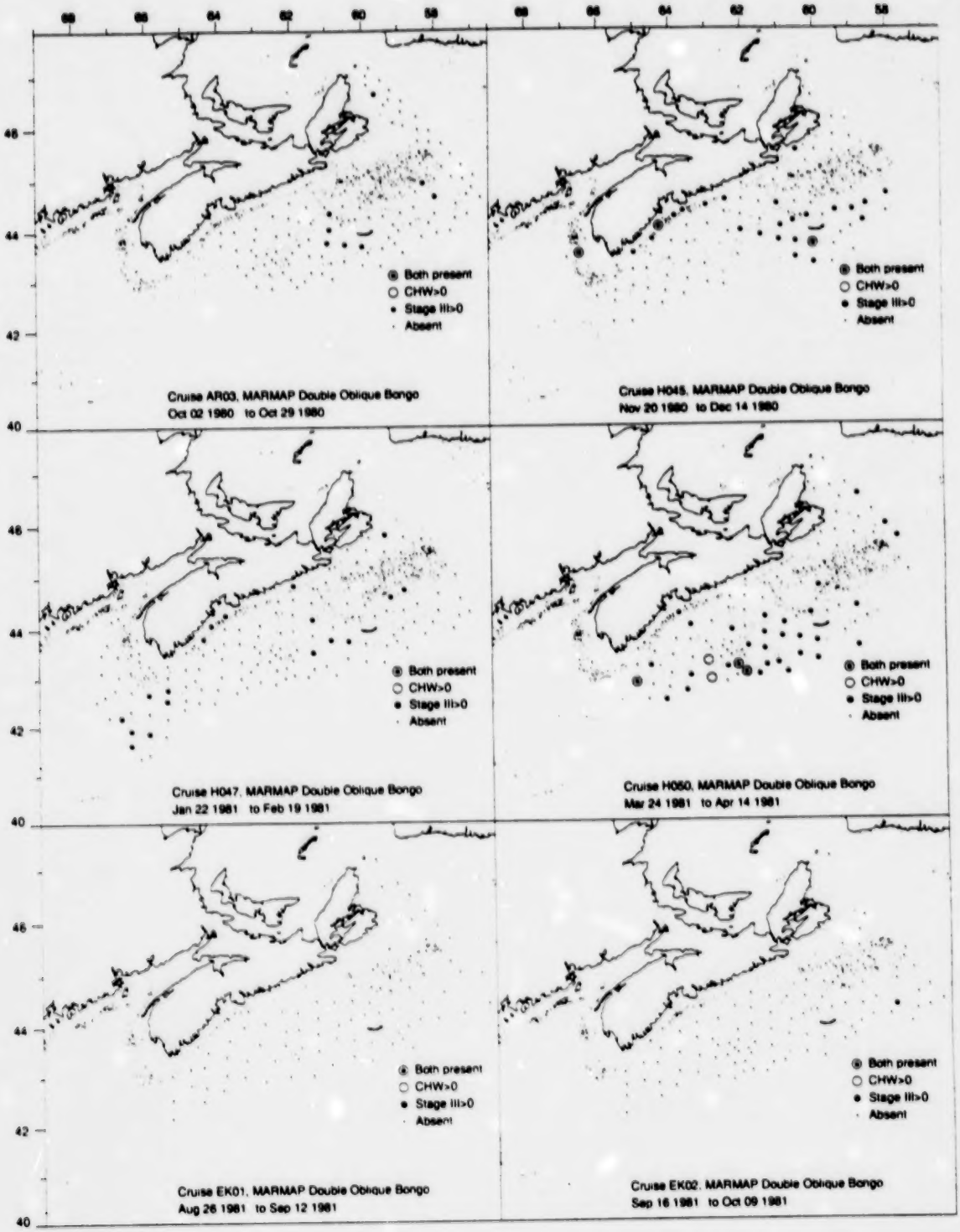
Both present
CHW>0
Stage III>0
Absent
Cruise AR03, MARMAP Double Oblique Bongo
Oct 02 1980 to Oct 29 1980
Cruise H045, MARMAP Double Oblique Bongo
Nov 20 1980 to Dec 14 1980
Cruise H047, MARMAP Double Oblique Bongo
Jan 22 1981 to Feb 19 1981
Cruise H050, MARMAP Double Oblique Bongo
Mar 24 1981 to Apr 14 1981
Cruise EK01, MARMAP Double Oblique Bongo
Aug 26 1981 to Sep 12 1981
Cruise EK02, MARMAP Double Oblique Bongo
Sep 16 1981 to Oct 09 1981

Fig. 8.4.3. (continued).

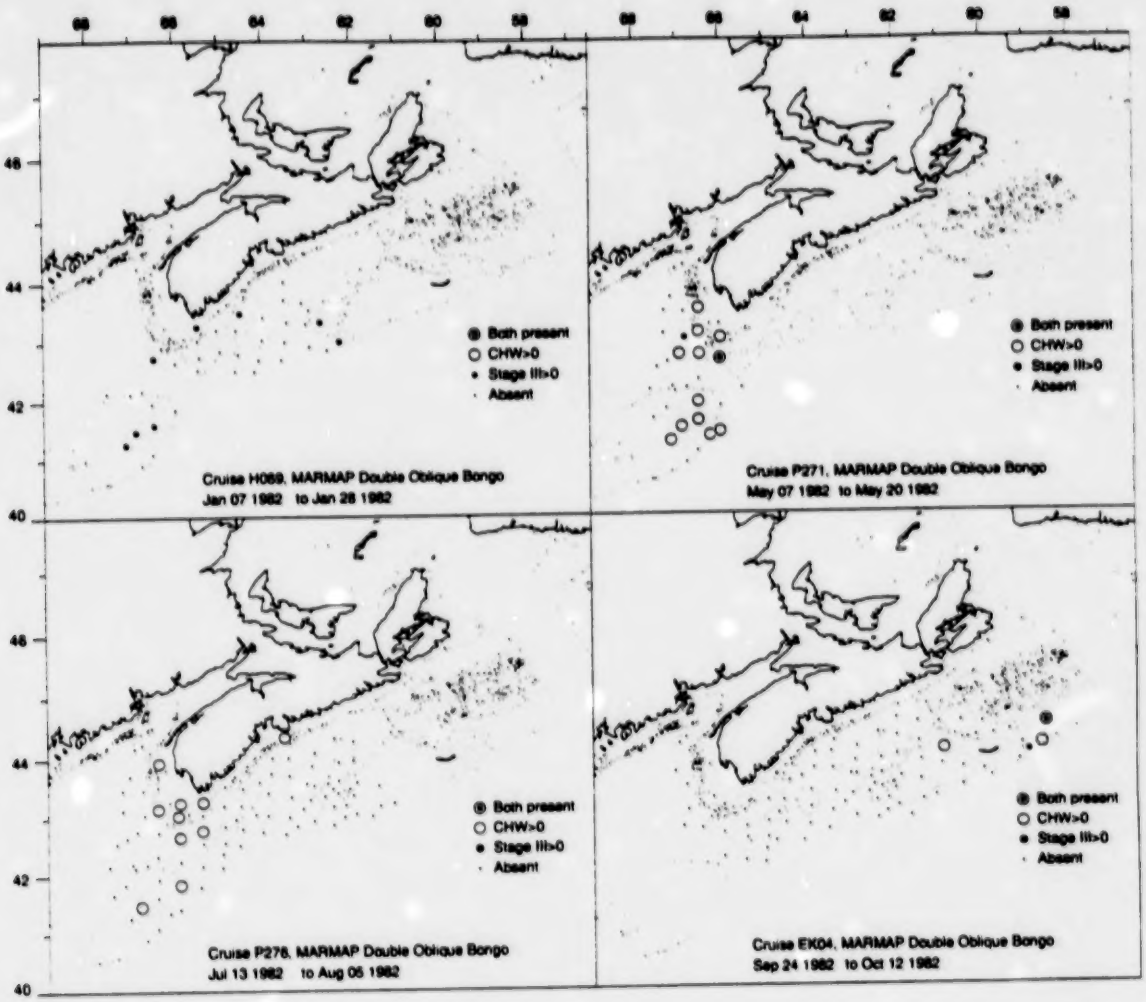
Both present
CHW>0
Stage III>0
Absent
Cruise H069, MARMAP Double Oblique Bongo
Jan 07 1982 to Jan 28 1982
Cruise P271, MARMAP Double Oblique Bongo
May 07 1982 to May 20 1982
Cruise P276, MARMAP Double Oblique Bongo
Jul 13 1982 to Aug 05 1982
Cruise EX04, MARMAP Double Oblique Bongo
Sep 24 1982 to Oct 12 1982

Fig. 8.4.3. (continued).

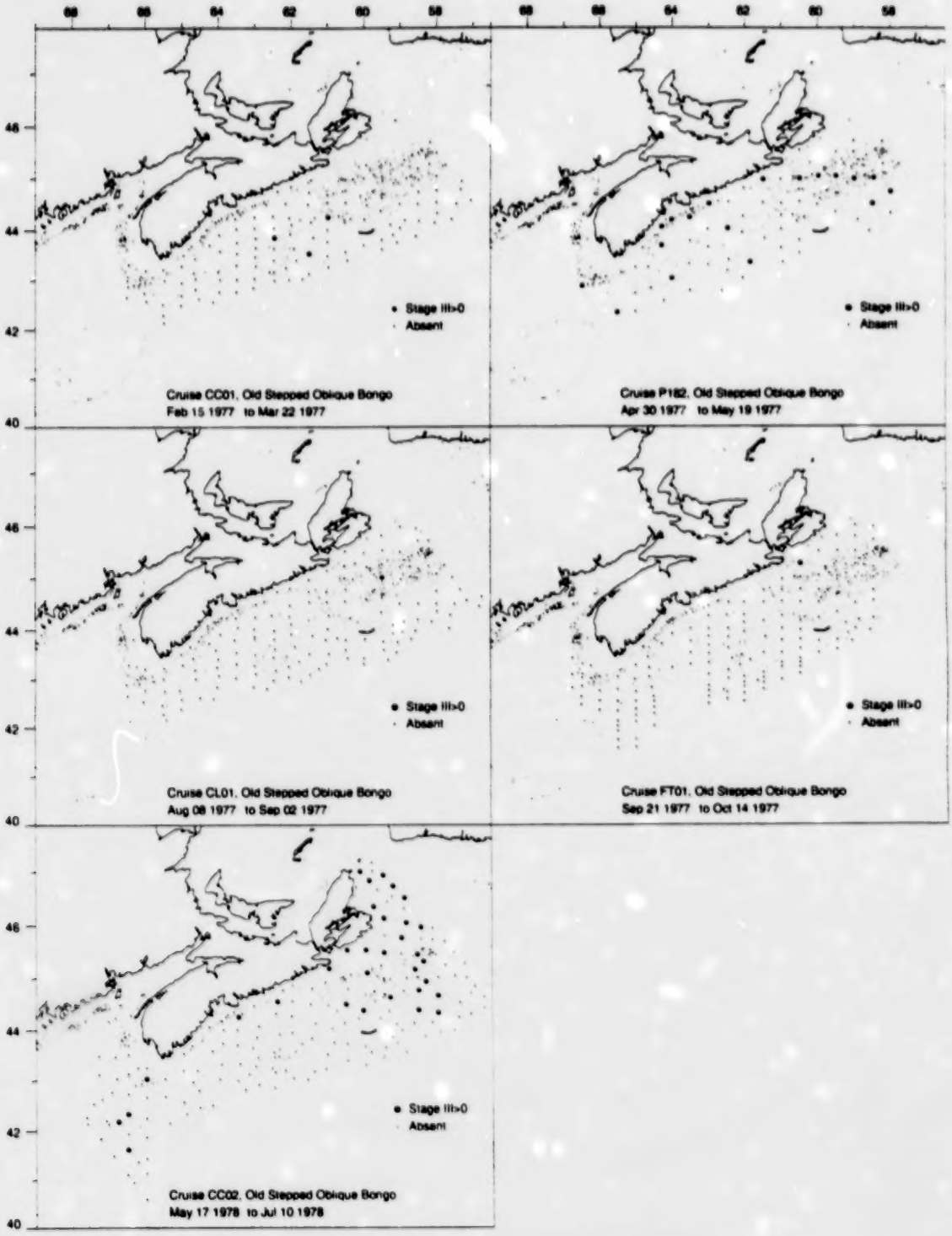
Stage III>0
Absent
Cruise CC01, Old Stepped Oblique Bongo
Feb 15 1977 to Mar 22 1977
Cruise P182, Old Stepped Oblique Bongo
Apr 30 1977 to May 19 1977
Cruise CL01, Old Stepped Oblique Bongo
Aug 08 1977 to Sep 02 1977
Cruise FT01, Old Stepped Oblique Bongo
Sep 21 1977 to Oct 14 1977
Cruise CC02, Old Stepped Oblique Bongo
May 17 1978 to Jul 10 1978

Fig. 8.4.4. Scotian Shelf Ichthyoplankton Program Cruises: Stage III cod eggs.

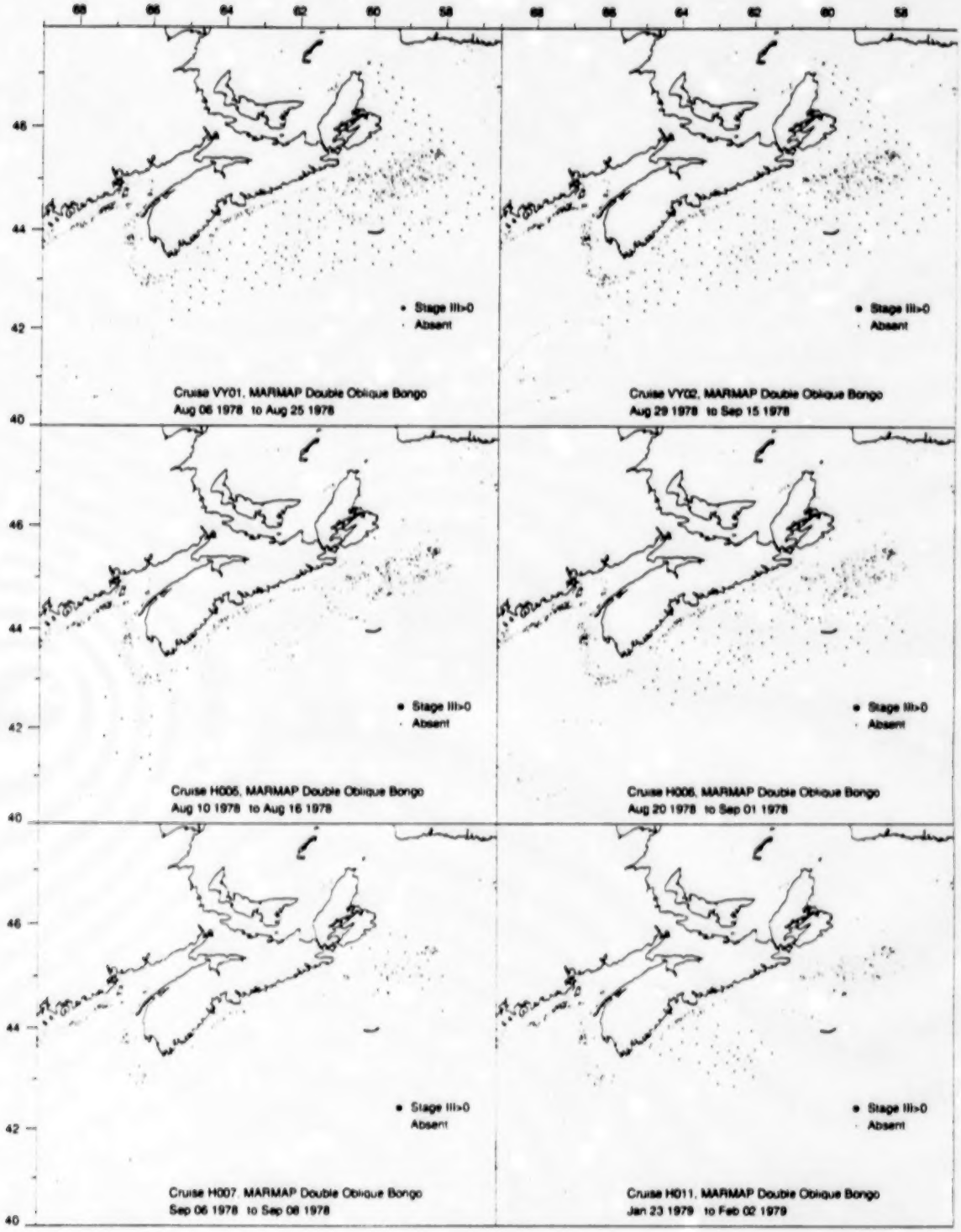
Stage III>0
Absent
Cruise VY01, MARMAP Double Oblique Bongo
Aug 06 1978 to Aug 25 1978
Cruise VY02, MARMAP Double Oblique Bongo
Aug 29 1978 to Sep 15 1978
Cruise H005, MARMAP Double Oblique Bongo
Aug 10 1978 to Aug 16 1978
Cruise H006, MARMAP Double Oblique Bongo
Aug 20 1978 to Sep 01 1978
Cruise H007, MARMAP Double Oblique Bongo
Sep 06 1978 to Sep 08 1978
Cruise H011, MARMAP Double Oblique Bongo
Jan 23 1979 to Feb 02 1979

Fig. 8.4.4. (continued).

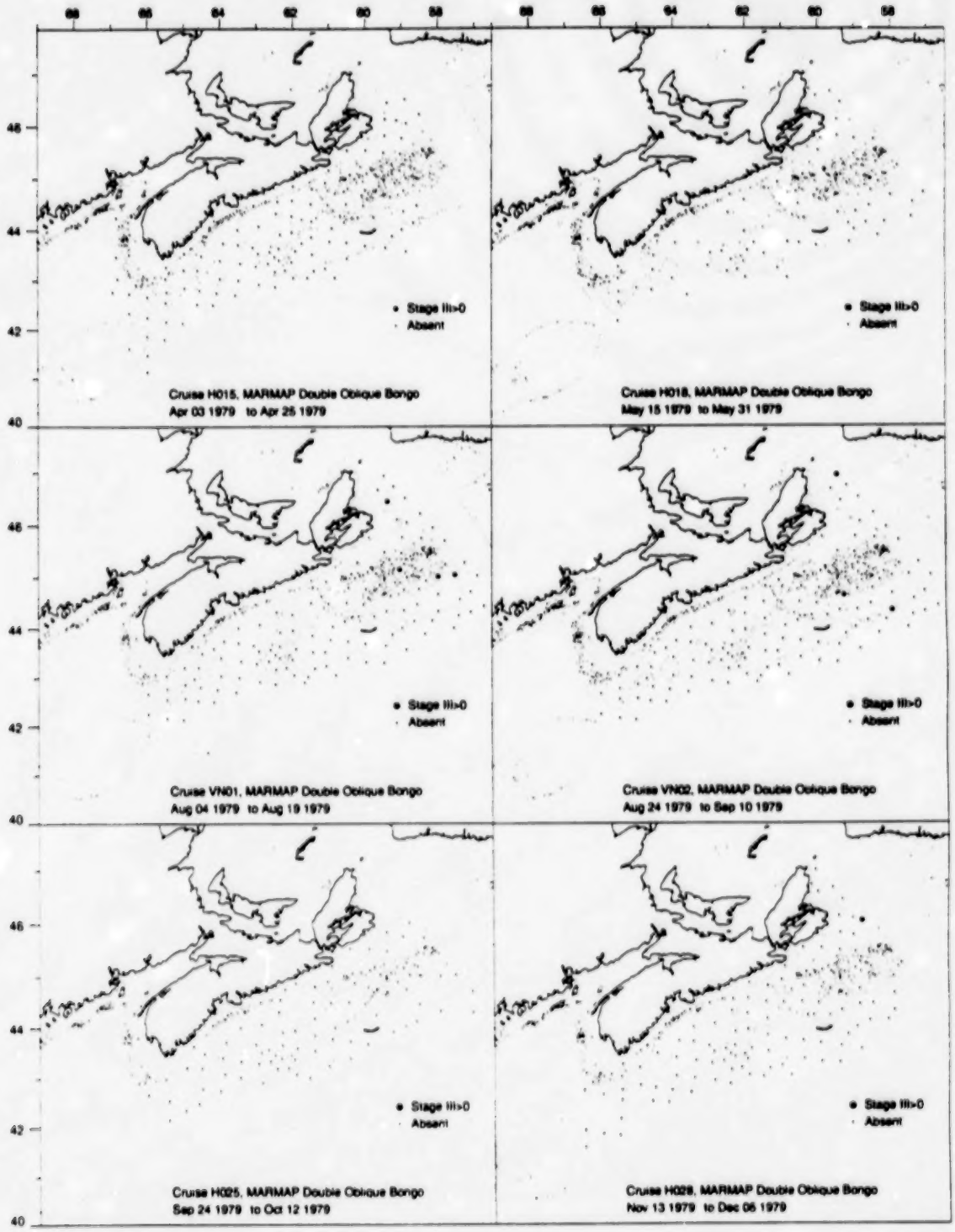
Stage III>0
Absent
Cruise H015, MARMAP Double Oblique Bongo
Apr 03 1979 to Apr 25 1979
Cruise H018, MARMAP Double Oblique Bongo
May 15 1979 to May 31 1979
Cruise VN01, MARMAP Double Oblique Bongo
Aug 04 1979 to Aug 19 1979
Cruise VN02, MARMAP Double Oblique Bongo
Aug 24 1979 to Sep 10 1979
Cruise H025, MARMAP Double Oblique Bongo
Sep 24 1979 to Oct 12 1979
Cruise H028, MARMAP Double Oblique Bongo
Nov 13 1979 to Dec 06 1979

Fig. 8.4.4. (continued).

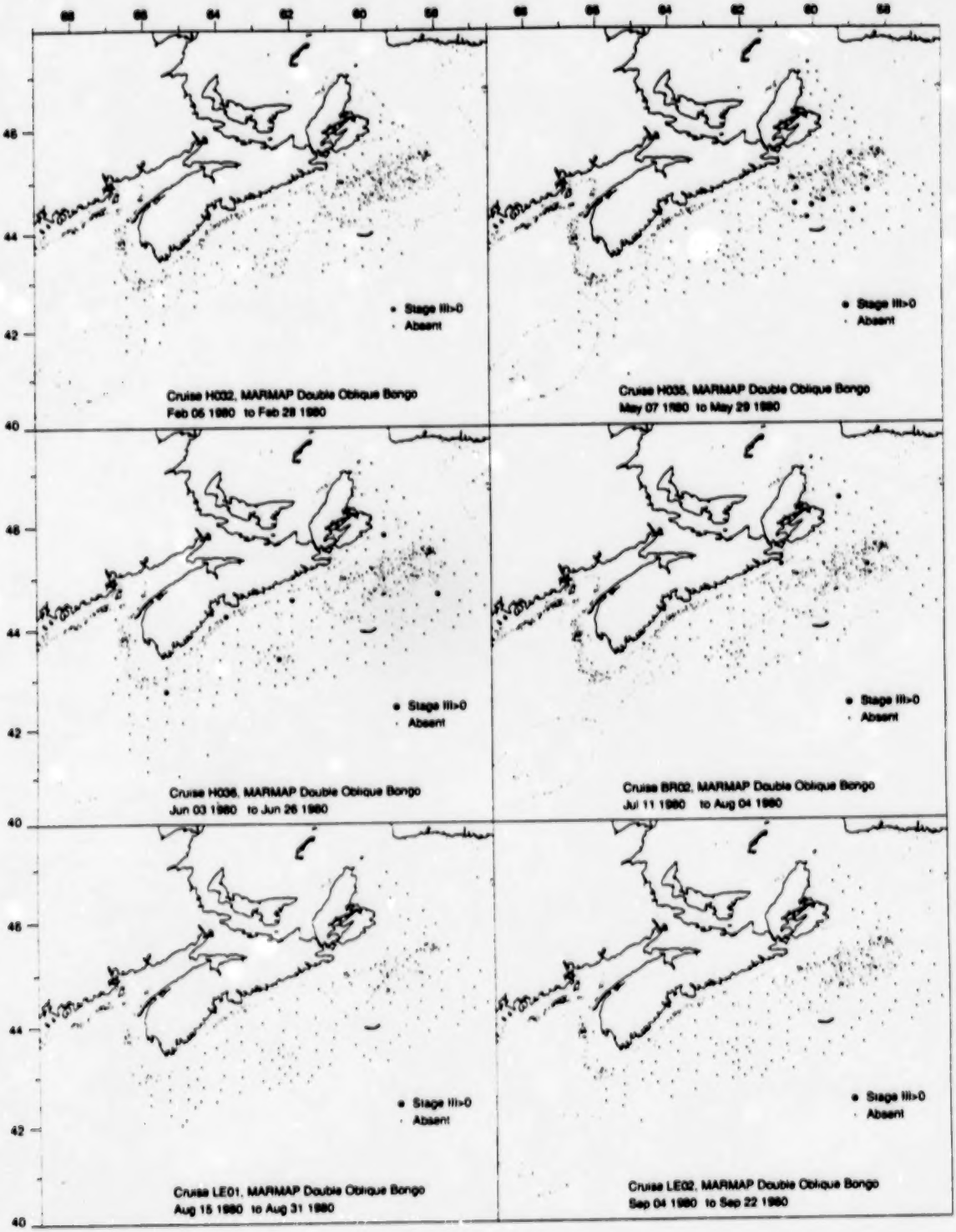
Stage III>0
Absent
Cruise H032, MARMAP Double Oblique Bongo
Feb 05 1980 to Feb 28 1980
Cruise H035, MARMAP Double Oblique Bongo
May 07 1980 to May 29 1980
Cruise H036, MARMAP Double Oblique Bongo
Jun 03 1980 to Jun 26 1980
Cruise BR02, MARMAP Double Oblique Bongo
Jul 11 1980 to Aug 04 1980
Cruise LE01, MARMAP Double Oblique Bongo
Aug 15 1980 to Aug 31 1980
Cruise LE02, MARMAP Double Oblique Bongo
Sep 04 1980 to Sep 22 1980

Fig. 8.4.4. (continued).

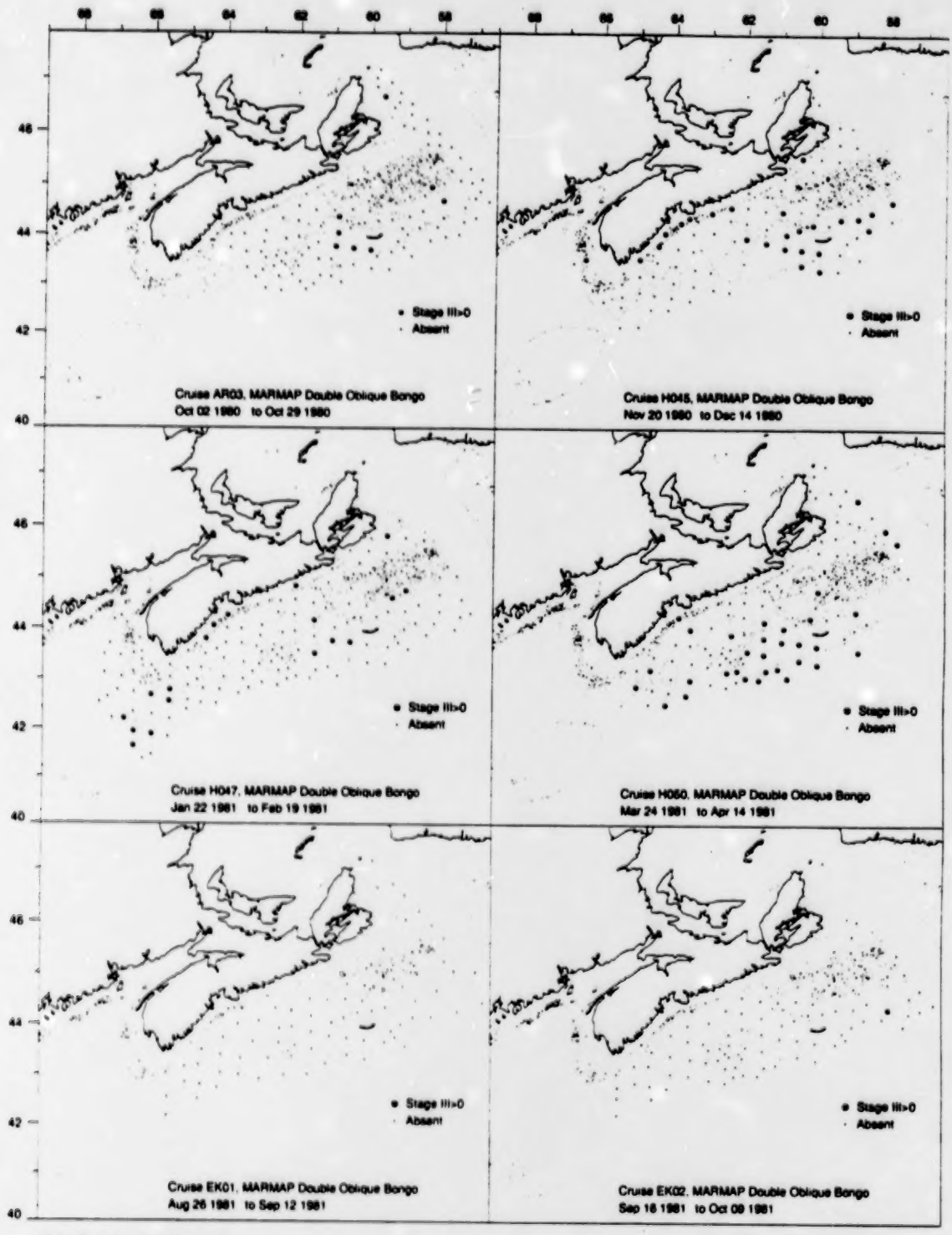
Stage III>0
Absent
Cruise AR03, MARMAP Double Oblique Bongo
Oct 02 1980 to Oct 29 1980
Cruise H045, MARMAP Double Oblique Bongo
Nov 20 1980 to Dec 14 1980
Cruise H047, MARMAP Double Oblique Bongo
Jan 22 1981 to Feb 19 1981
Cruise H050, MARMAP Double Oblique Bongo
Mar 24 1981 to Apr 14 1981
Cruise EK01, MARMAP Double Oblique Bongo
Aug 26 1981 to Sep 12 1981
Cruise EK02, MARMAP Double Oblique Bongo
Sep 16 1981 to Oct 09 1981

Fig. 8.4.4. (continued).

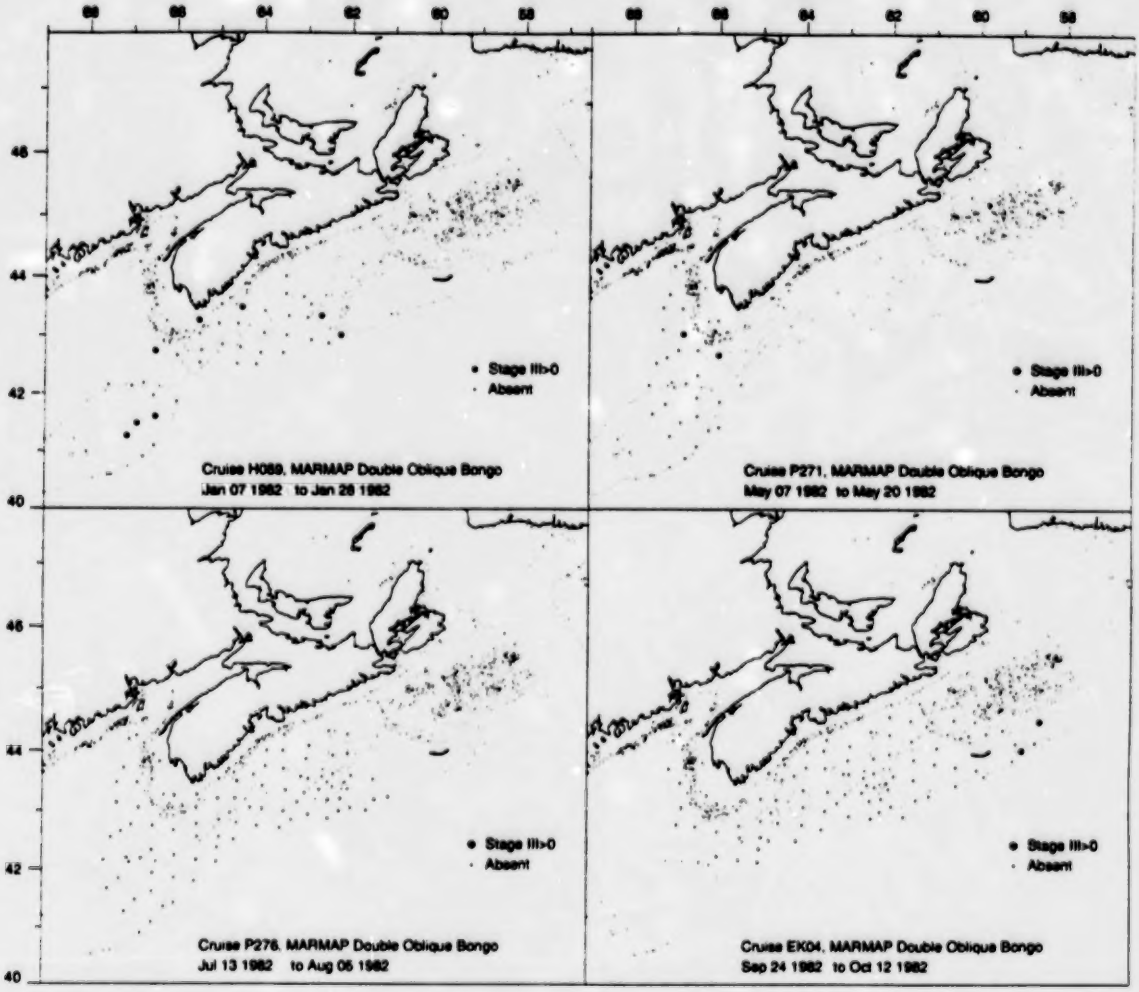
Stage III>0
Absent
Cruise H089, MARMAP Double Oblique Bongo
Jan 07 1982 to Jan 28 1982
Cruise P271, MARMAP Double Oblique Bongo
May 07 1982 to May 20 1982
Cruise P276, MARMAP Double Oblique Bongo
Jul 13 1982 to Aug 05 1982
Cruise EK04, MARMAP Double Oblique Bongo
Sep 24 1982 to Oct 12 1982

Fig. 8.4.4. (continued).

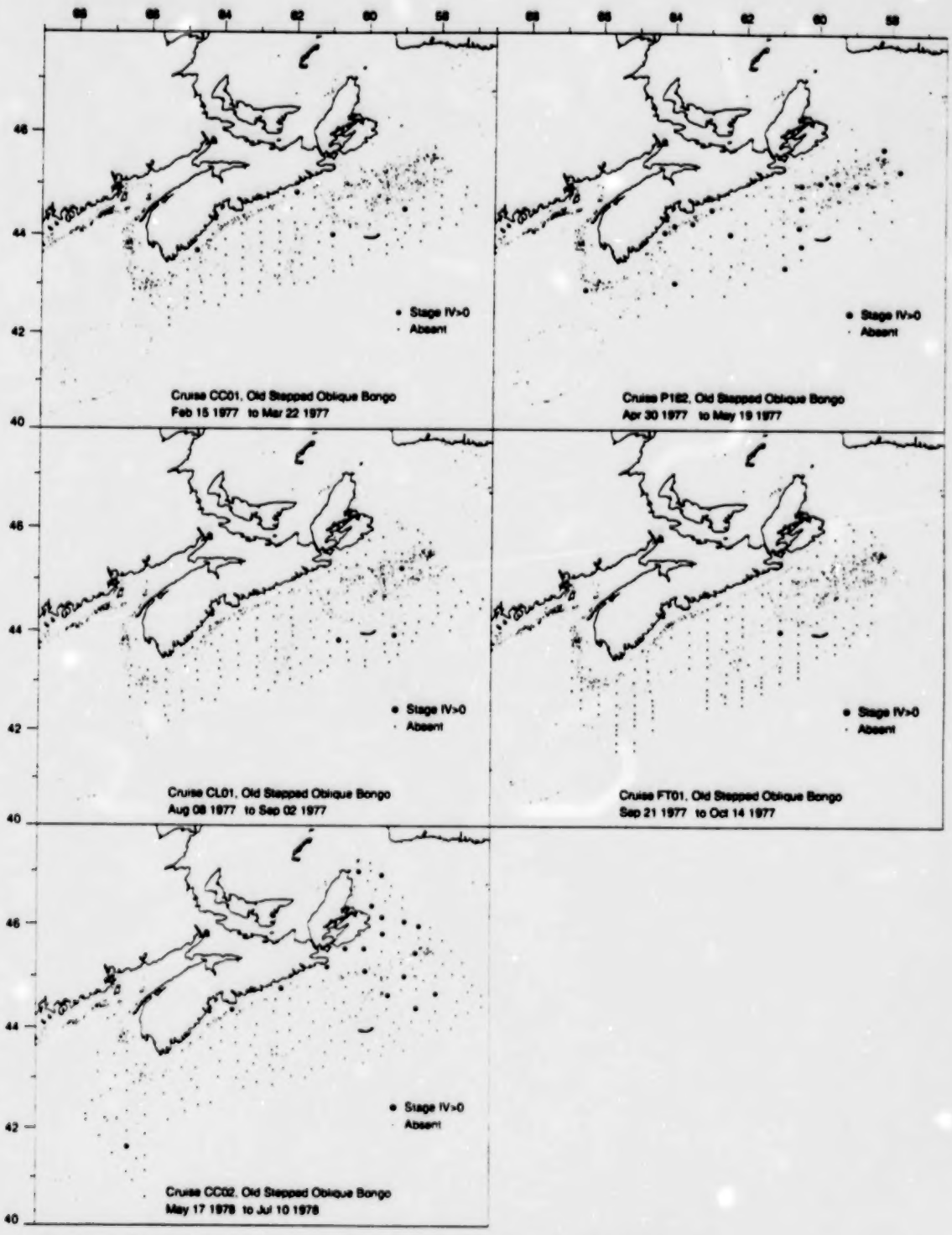

Fig. 8.4.5. Scotian Shelf Ichthyoplankton Program Cruises: Stage IV cod eggs.

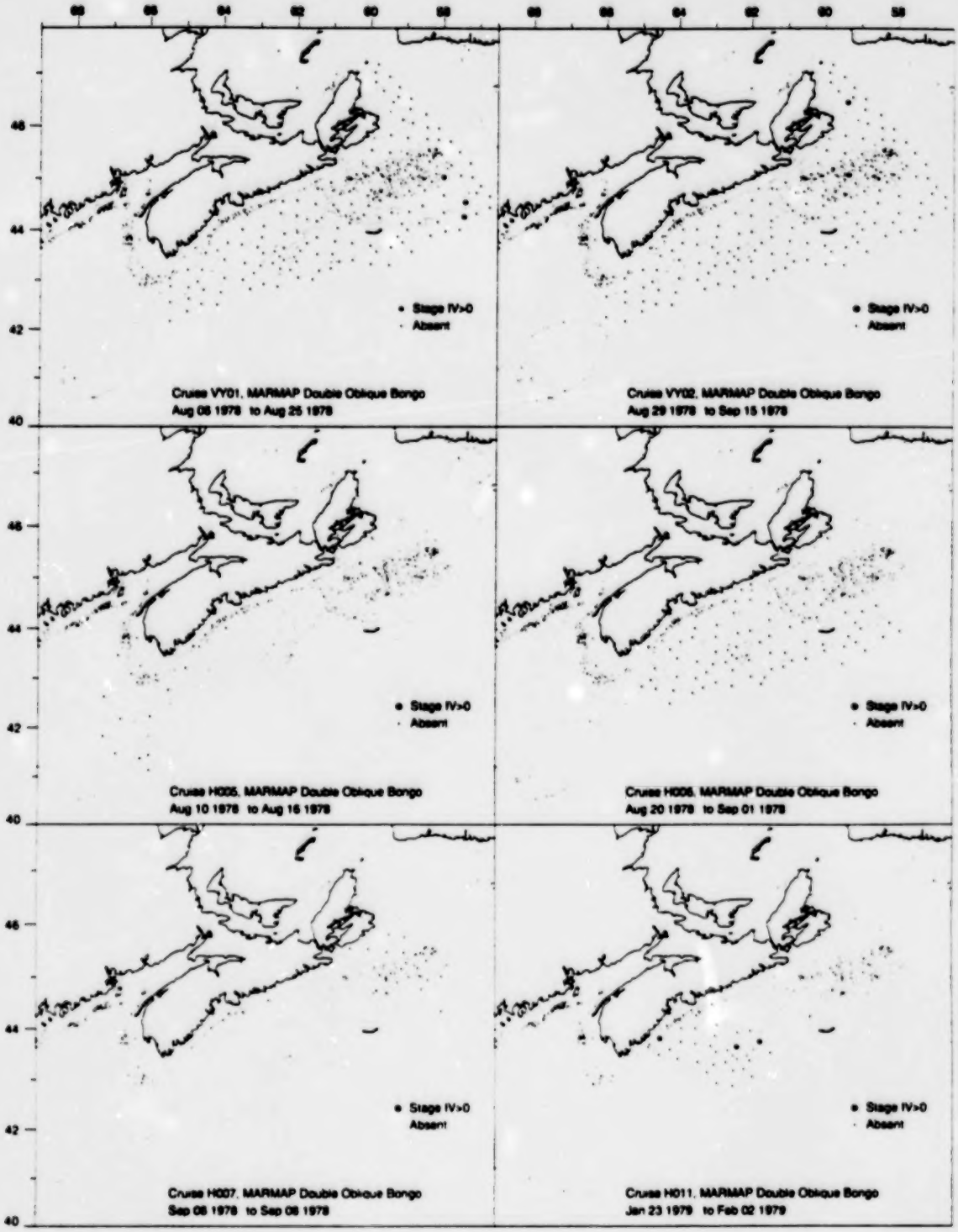
Stage IV>0
Absent
Cruise VY01, MARMAP Double Oblique Bongo
Aug 06 1978 to Aug 25 1978
Cruise VY02, MARMAP Double Oblique Bongo
Aug 29 1978 to Sep 15 1978
Cruise H005, MARMAP Double Oblique Bongo
Aug 10 1978 to Aug 16 1978
Cruise H006, MARMAP Double Oblique Bongo
Aug 20 1978 to Sep 01 1978
Cruise H007, MARMAP Double Oblique Bongo
Sep 06 1978 to Sep 08 1978
Cruise H011, MARMAP Double Oblique Bongo
Jan 23 1979 to Feb 02 1979

Fig. 8.4.5. (continued).

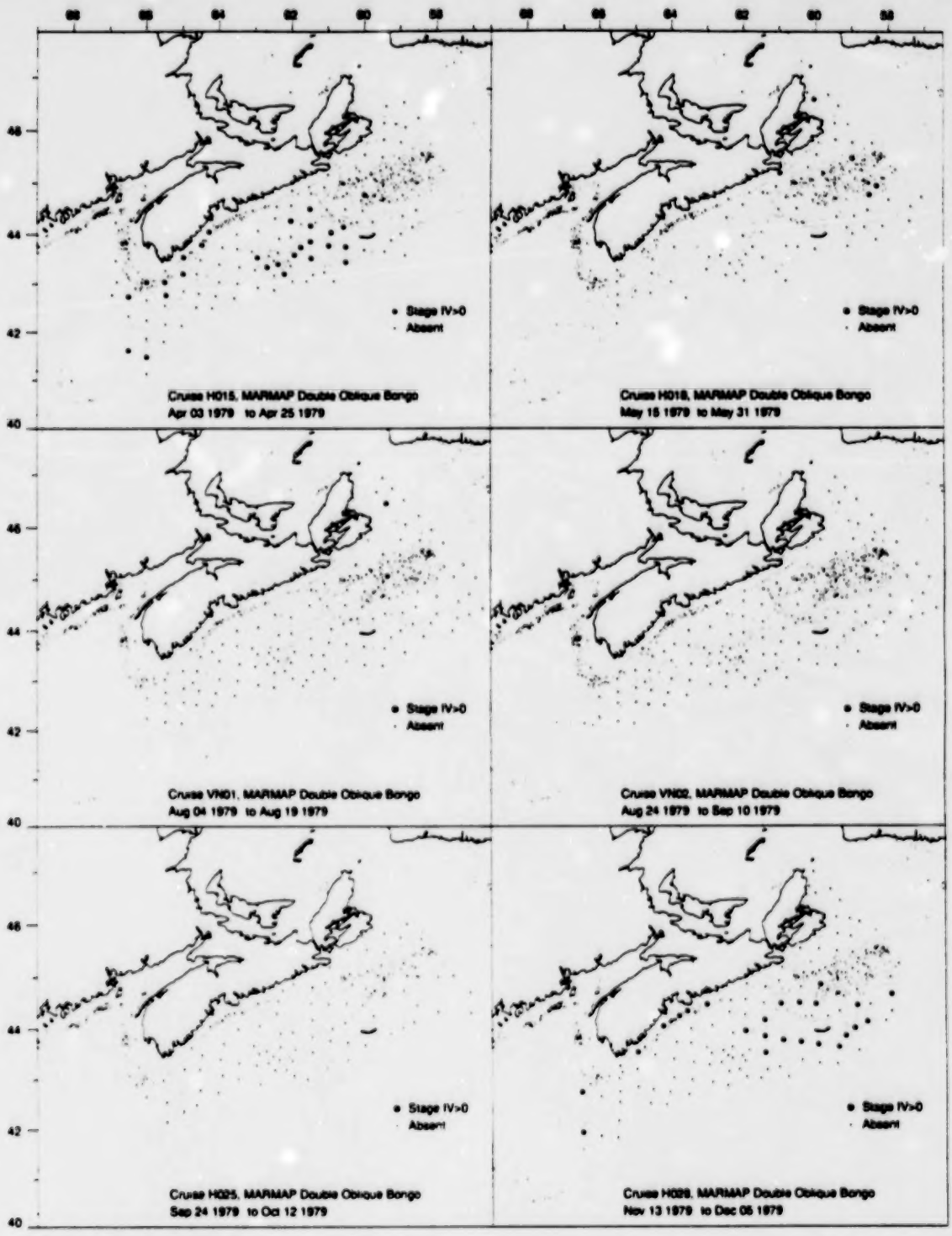
Stage IV>0
Absent
Cruise H015, MARMAP Double Oblique Bongo
Apr 03 1979 to Apr 25 1979
Cruise H018, MARMAP Double Oblique Bongo
May 15 1979 to May 31 1979
Cruise VN01, MARMAP Double Oblique Bongo
Aug 04 1979 to Aug 19 1979
Cruise VN02, MARMAP Double Oblique Bongo
Aug 24 1979 to Sep 10 1979
Cruise H025, MARMAP Double Oblique Bongo
Sep 24 1979 to Oct 12 1979
Cruise H028, MARMAP Double Oblique Bongo
Nov 13 1979 to Dec 05 1979

Fig. 8.4.5. (continued).

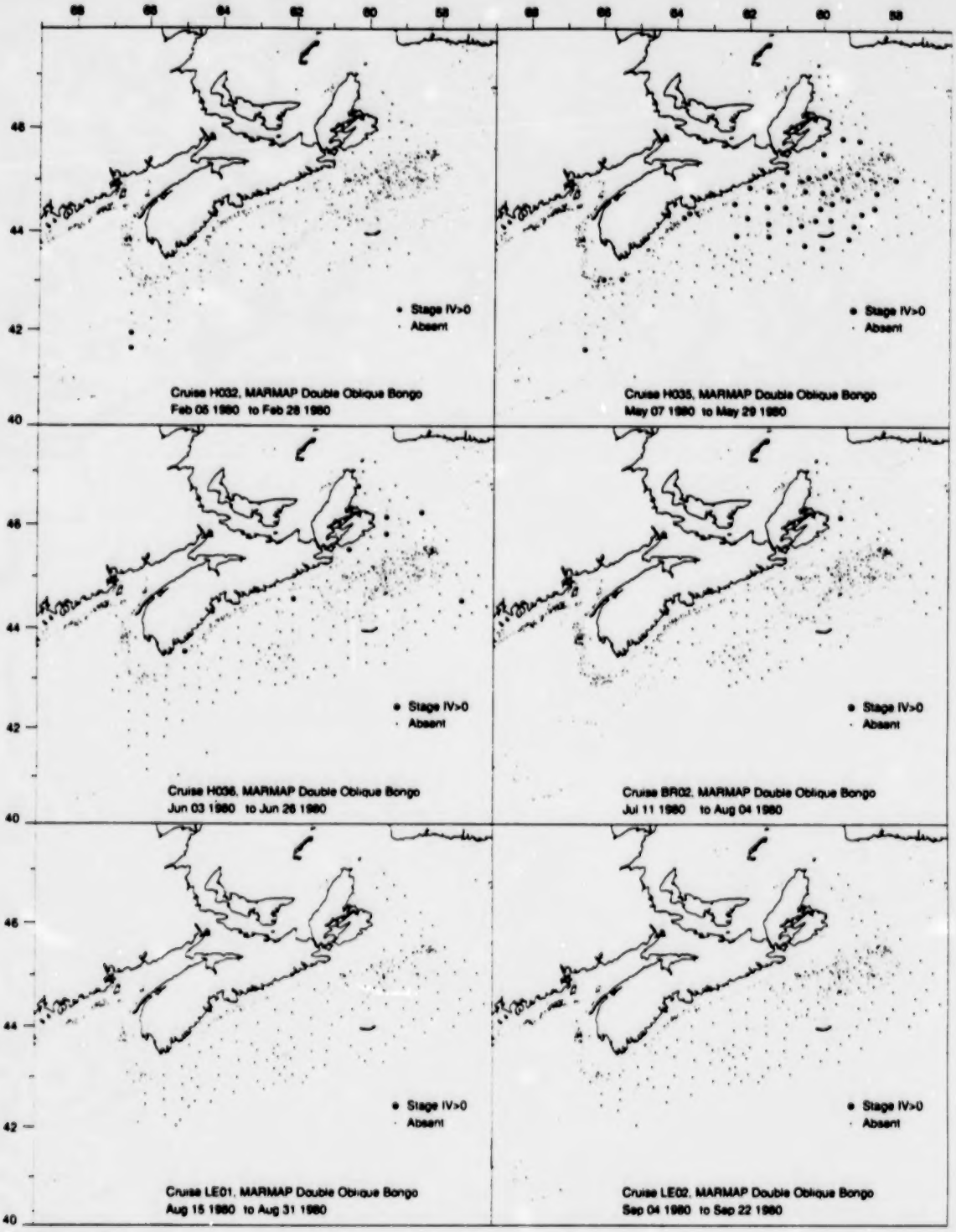
Stage IV>0
Absent
Cruise H032, MARMAP Double Oblique Bongo
Feb 05 1980 to Feb 28 1980
Cruise H035, MARMAP Double Oblique Bongo
May 07 1980 to May 29 1980
Cruise H036, MARMAP Double Oblique Bongo
Jun 03 1980 to Jun 26 1980
Cruise BR02, MARMAP Double Oblique Bongo
Jul 11 1980 to Aug 04 1980
Cruise LE01, MARMAP Double Oblique Bongo
Aug 15 1980 to Aug 31 1980
Cruise LE02, MARMAP Double Oblique Bongo
Sep 04 1980 to Sep 22 1980

Fig. 8.4.5. (continued).

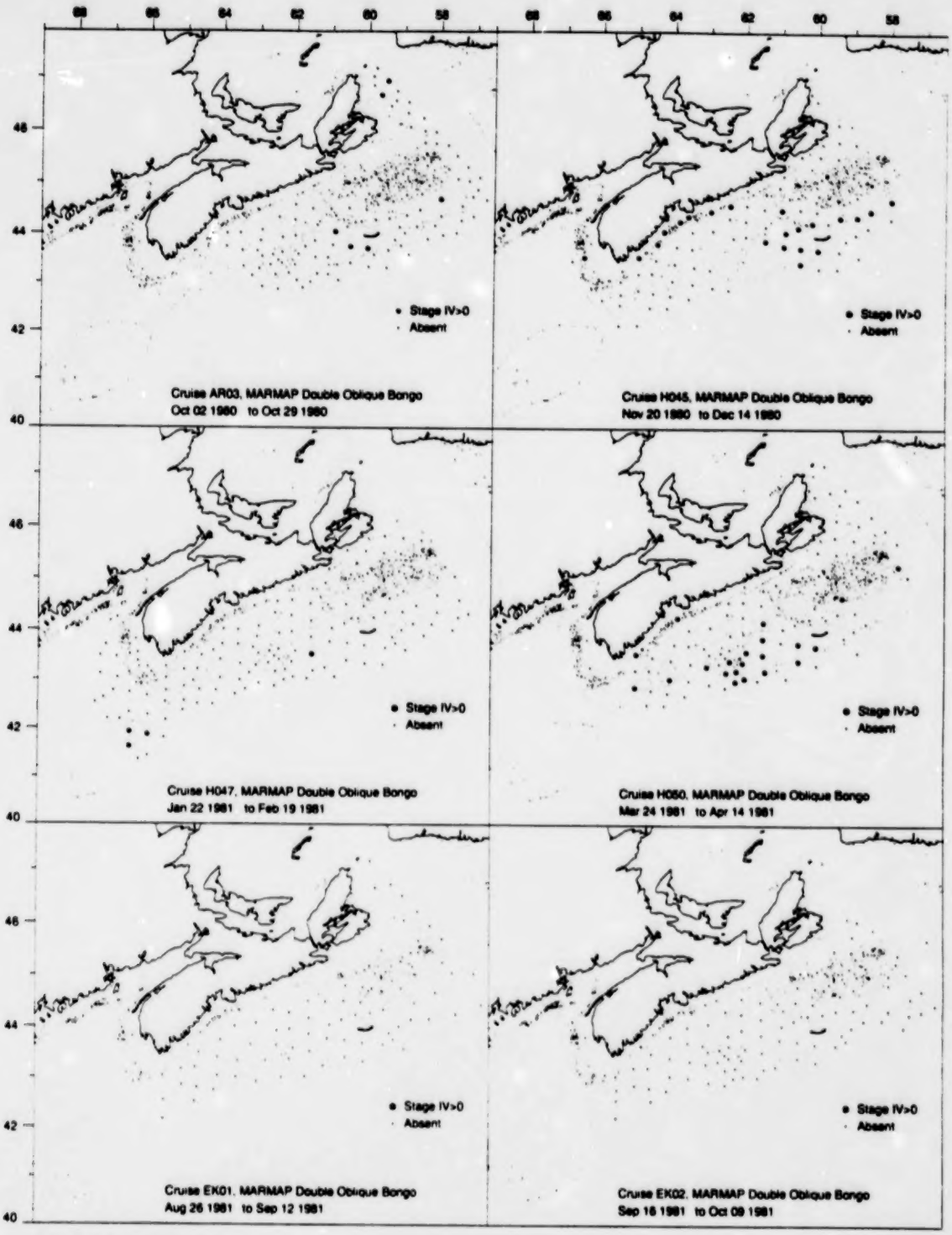
Stage IV>0
Absent
Cruise AR03, MARMAP Double Oblique Bongo
Oct 02 1980 to Oct 29 1980
Cruise H045, MARMAP Double Oblique Bongo
Nov 20 1980 to Dec 14 1980
Cruise H047, MARMAP Double Oblique Bongo
Jan 22 1981 to Feb 19 1981
Cruise H050, MARMAP Double Oblique Bongo
Mar 24 1981 to Apr 14 1981
Cruise EK01, MARMAP Double Oblique Bongo
Aug 26 1981 to Sep 12 1981
Cruise EK02, MARMAP Double Oblique Bongo
Sep 16 1981 to Oct 09 1981

Fig. 8.4.5. (continued).

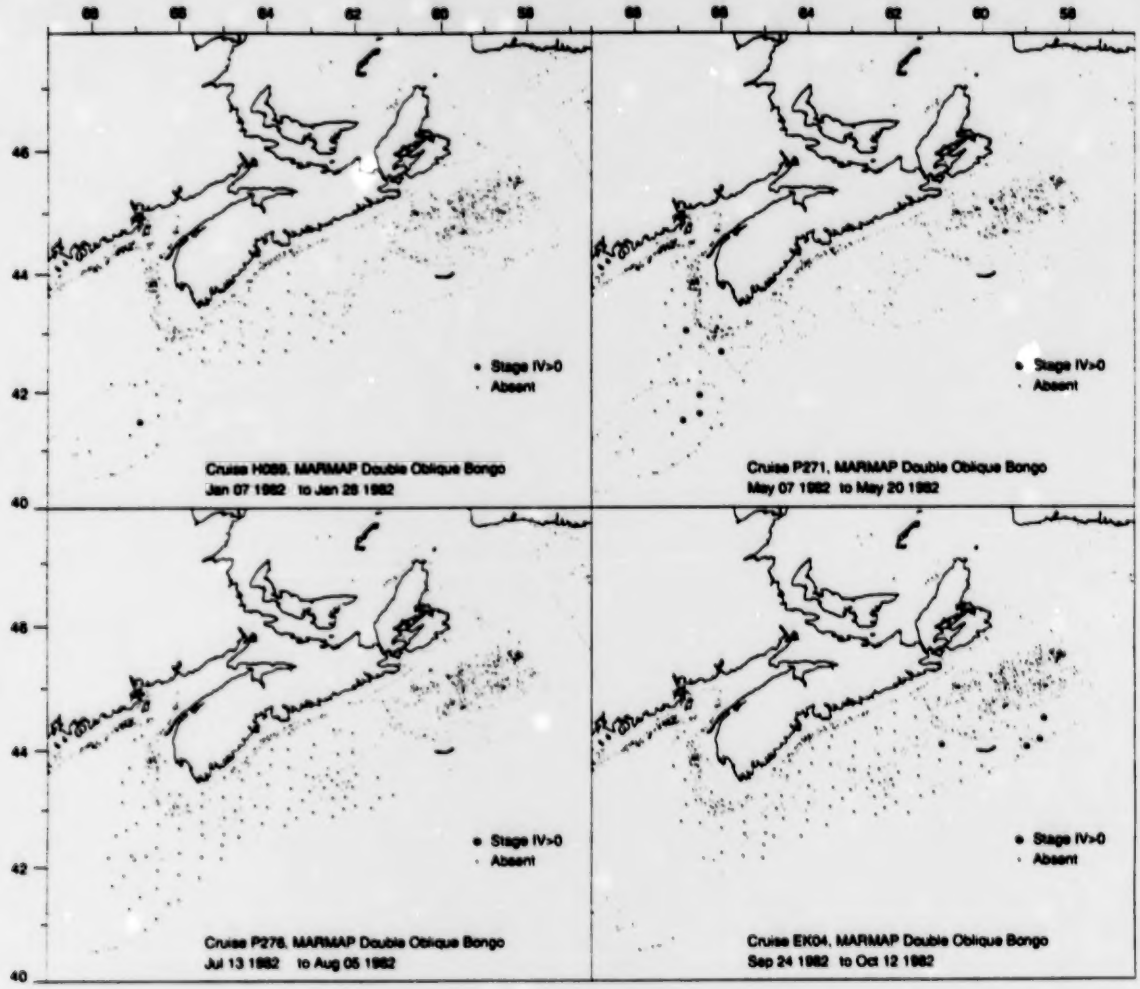

Fig. 8.4.5. (continued).

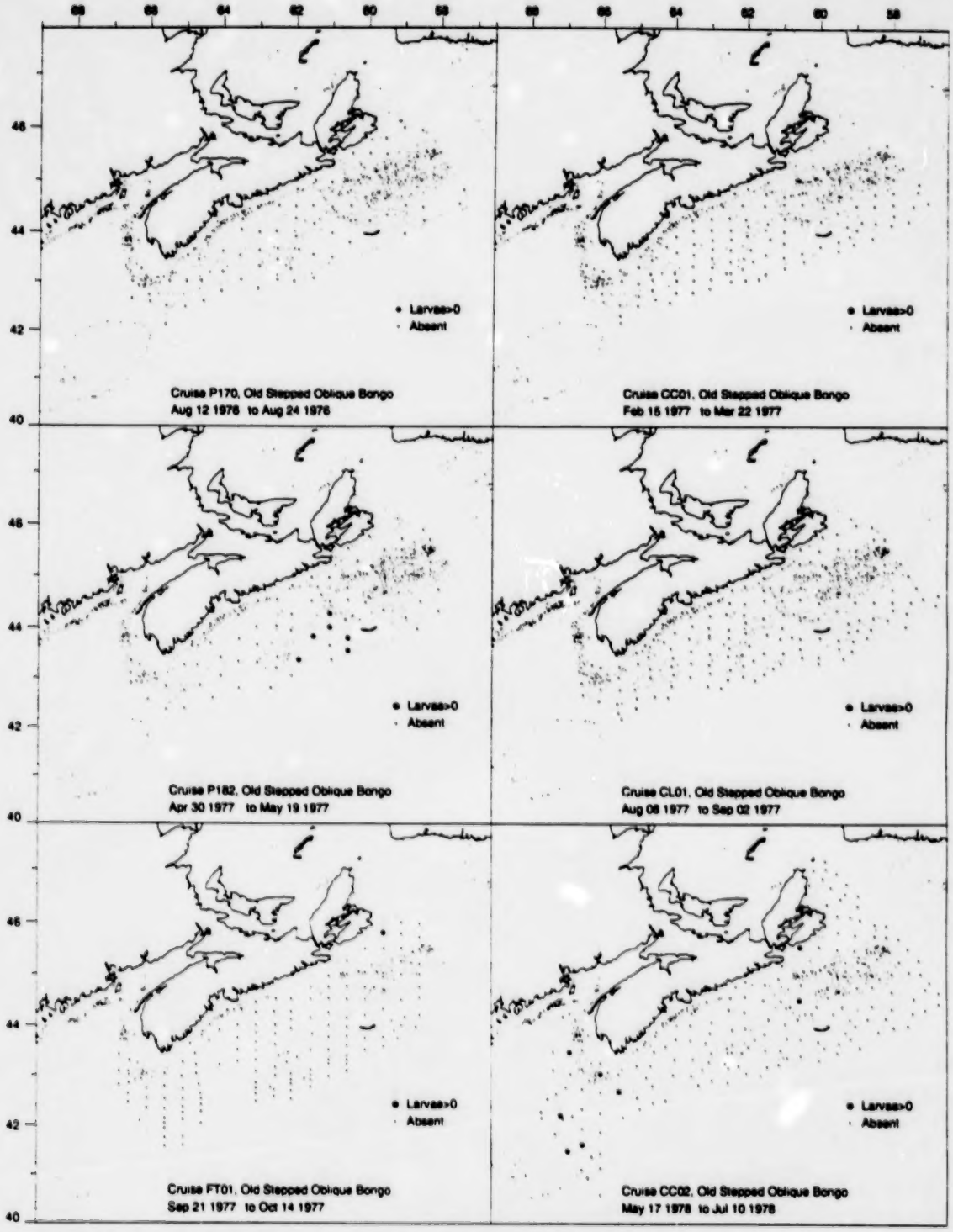
Larvae>0
Absent
Cruise P170, Old Stepped Oblique Bongo
Aug 12 1976 to Aug 24 1976
Cruise CC01, Old Stepped Oblique Bongo
Feb 15 1977 to Mar 22 1977
Cruise P182, Old Stepped Oblique Bongo
Apr 30 1977 to May 19 1977
Cruise CL01, Old Stepped Oblique Bongo
Aug 08 1977 to Sep 02 1977
Cruise FT01, Old Stepped Oblique Bongo
Sep 21 1977 to Oct 14 1977
Cruise CC02, Old Stepped Oblique Bongo
May 17 1978 to Jul 10 1978

Fig. 8.4.6. Scotian Shelf Ichthyoplankton Program Cruises: Cod larvae (1-7mm).

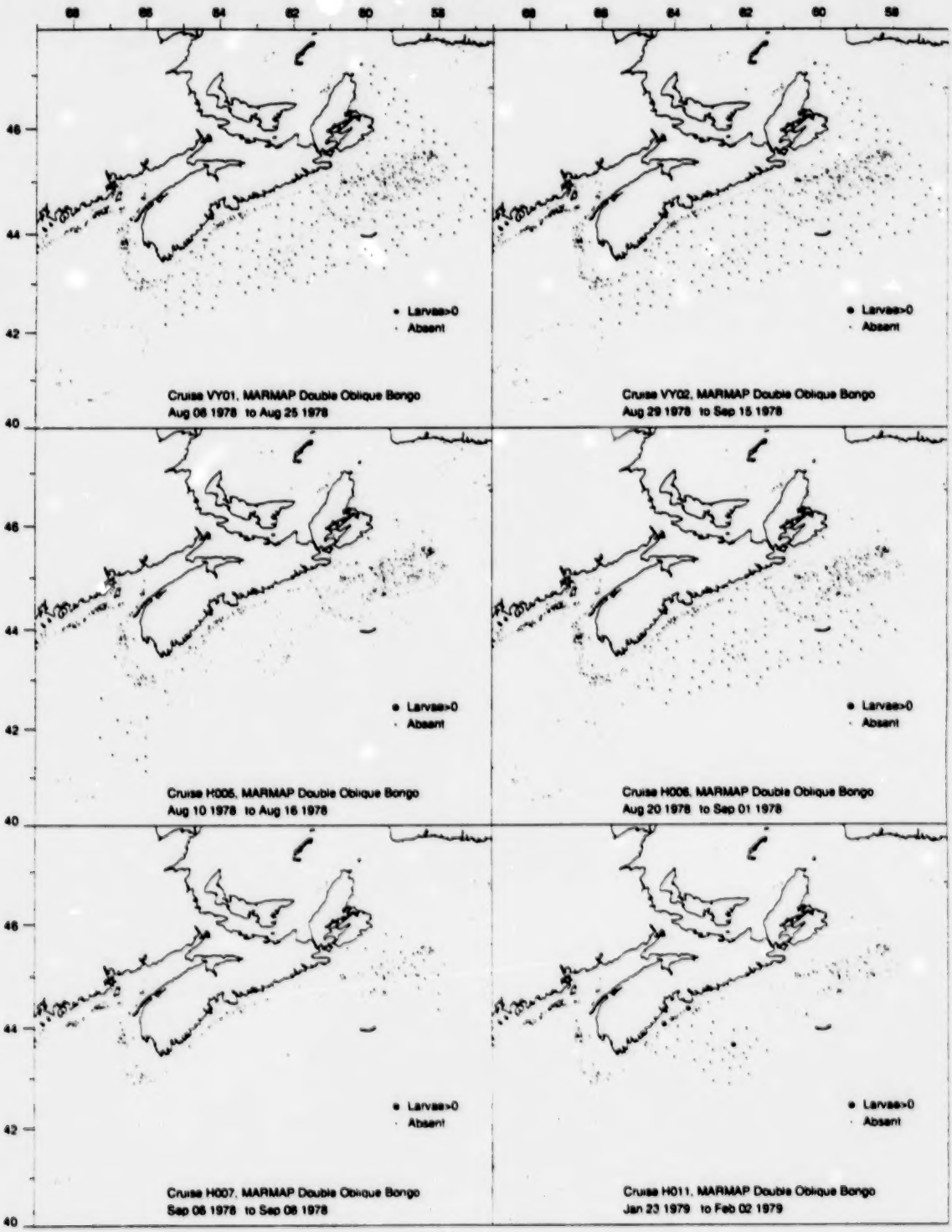

Fig. 8.4.6. (continued).

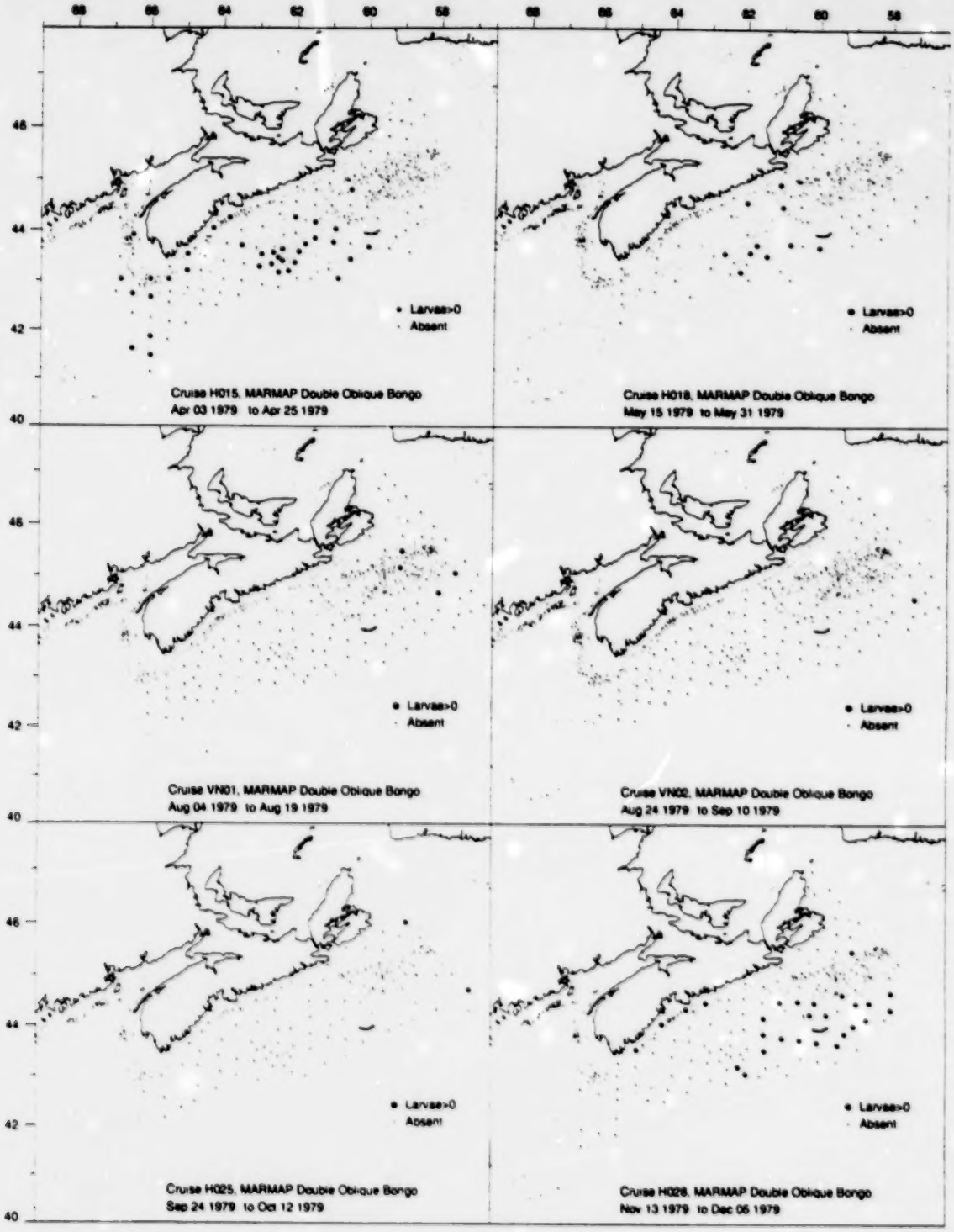

Fig. 8.4.6. (continued).

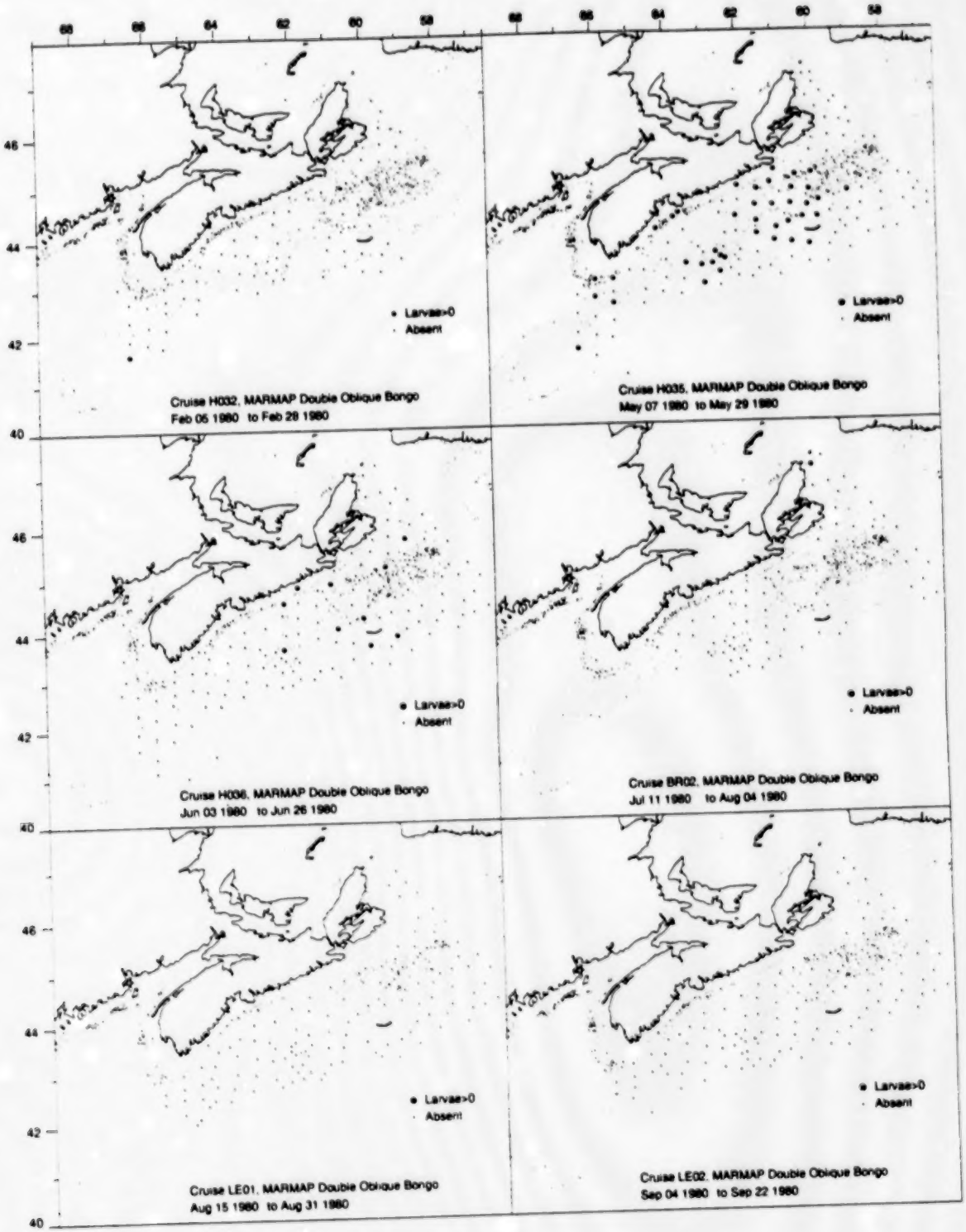
Larvae>0
Absent
Cruise H032, MARMAP Double Oblique Bongo
Feb 05 1980 to Feb 28 1980
Cruise H035, MARMAP Double Oblique Bongo
May 07 1980 to May 29 1980
Cruise H036, MARMAP Double Oblique Bongo
Jun 03 1980 to Jun 26 1980
Cruise BR02, MARMAP Double Oblique Bongo
Jul 11 1980 to Aug 04 1980
Cruise LE01, MARMAP Double Oblique Bongo
Aug 15 1980 to Aug 31 1980
Cruise LE02, MARMAP Double Oblique Bongo
Sep 04 1980 to Sep 22 1980

Fig. 8.4.6. (continued).

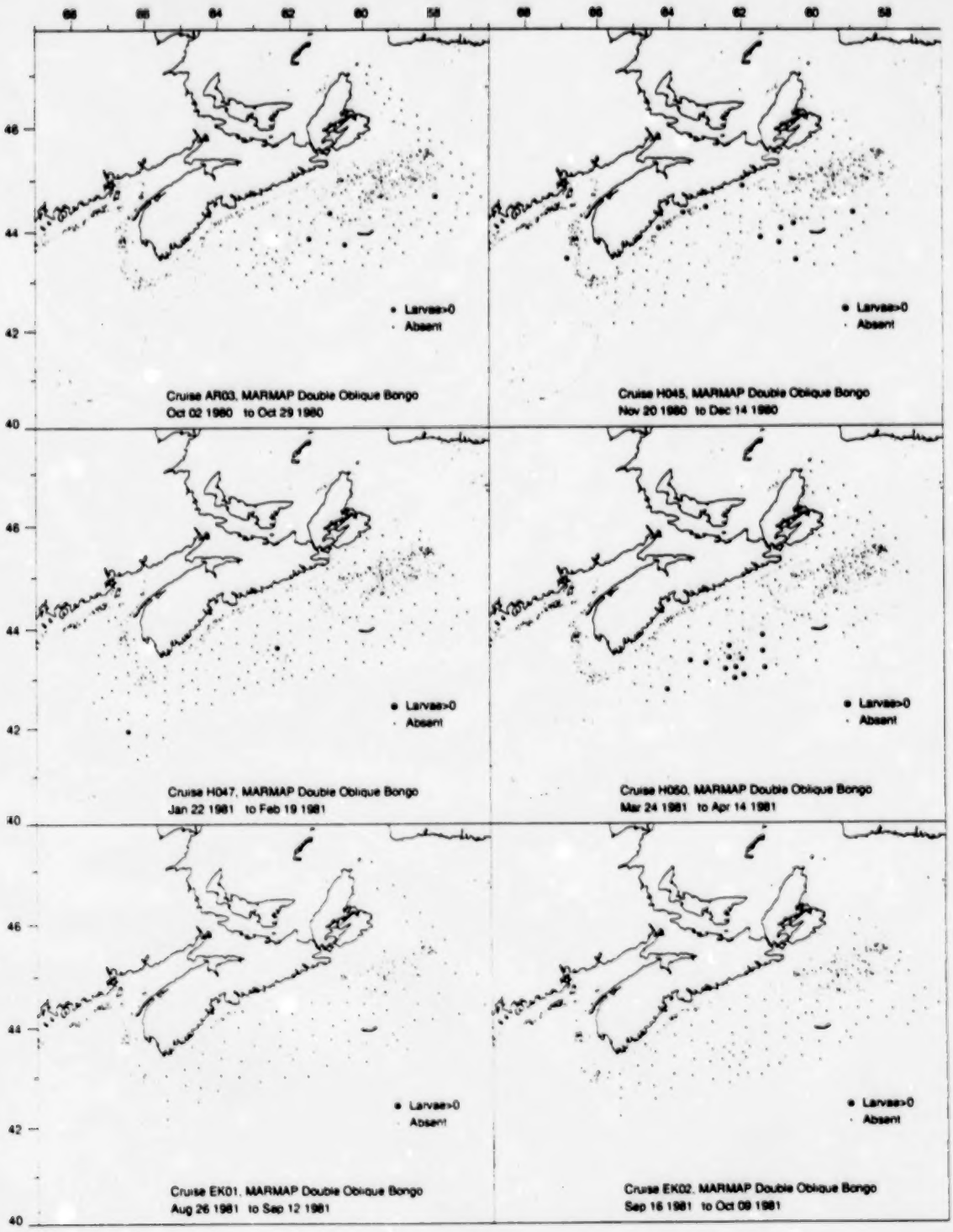
Larvae>0
Absent
Cruise AR03, MARMAP Double Oblique Bongo
Oct 02 1980 to Oct 29 1980
Cruise H045, MARMAP Double Oblique Bongo
Nov 20 1980 to Dec 14 1980
Cruise H047, MARMAP Double Oblique Bongo
Jan 22 1981 to Feb 19 1981
Cruise H050, MARMAP Double Oblique Bongo
Mar 24 1981 to Apr 14 1981
Cruise EK01, MARMAP Double Oblique Bongo
Aug 26 1981 to Sep 12 1981
Cruise EK02, MARMAP Double Oblique Bongo
Sep 16 1981 to Oct 09 1981

Fig. 8.4.6. (continued).

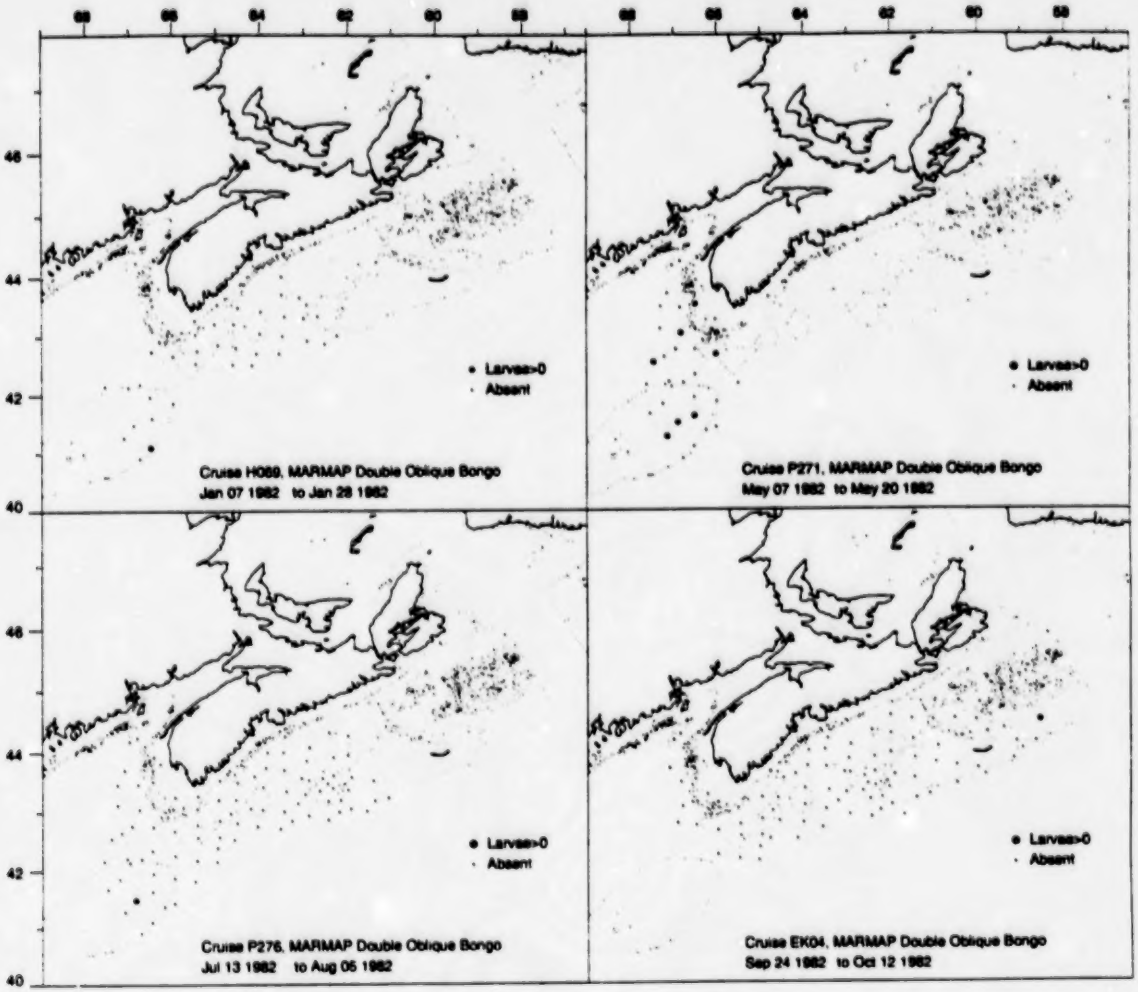
Larvae>0
Absent
Cruise H089, MARMAP Double Oblique Bongo
Jan 07 1982 to Jan 28 1982
Cruise P271, MARMAP Double Oblique Bongo
May 07 1982 to May 20 1982
Cruise P276, MARMAP Double Oblique Bongo
Jul 13 1982 to Aug 05 1982
Cruise EK04, MARMAP Double Oblique Bongo
Sep 24 1982 to Oct 12 1982

Fig. 8.4.6. (continued).

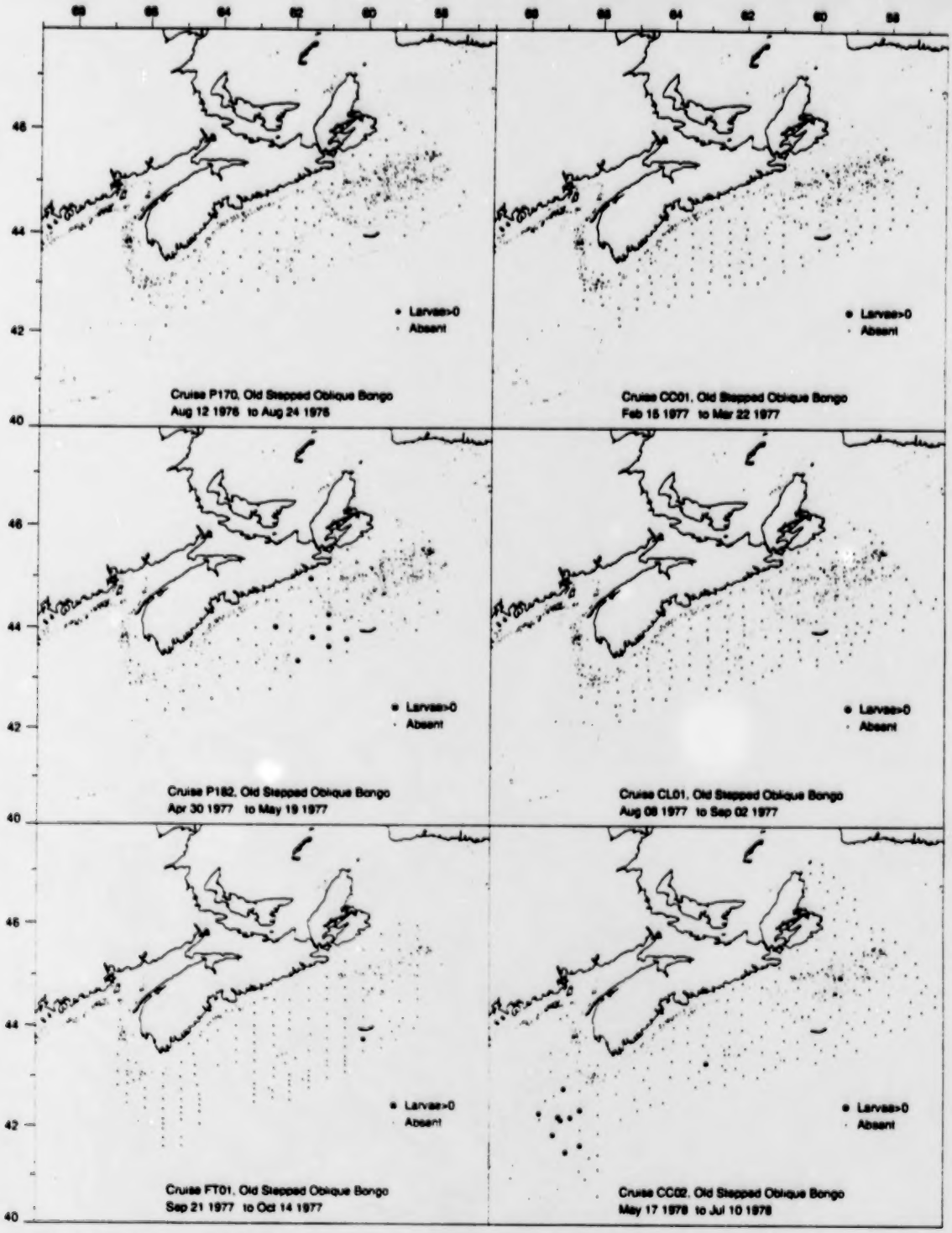
Larvae>0
Absent
Cruise P170, Old Stepped Oblique Bongo
Aug 12 1976 to Aug 24 1976
Cruise CC01, Old Stepped Oblique Bongo
Feb 15 1977 to Mar 22 1977
Cruise P182, Old Stepped Oblique Bongo
Apr 30 1977 to May 19 1977
Cruise CL01, Old Stepped Oblique Bongo
Aug 08 1977 to Sep 02 1977
Cruise FT01, Old Stepped Oblique Bongo
Sep 21 1977 to Oct 14 1977
Cruise CC02, Old Stepped Oblique Bongo
May 17 1978 to Jul 10 1978

Fig. 8.4.7. Scotian Shelf Ichthyoplankton Program Cruises: Cod larvae (7+mm).

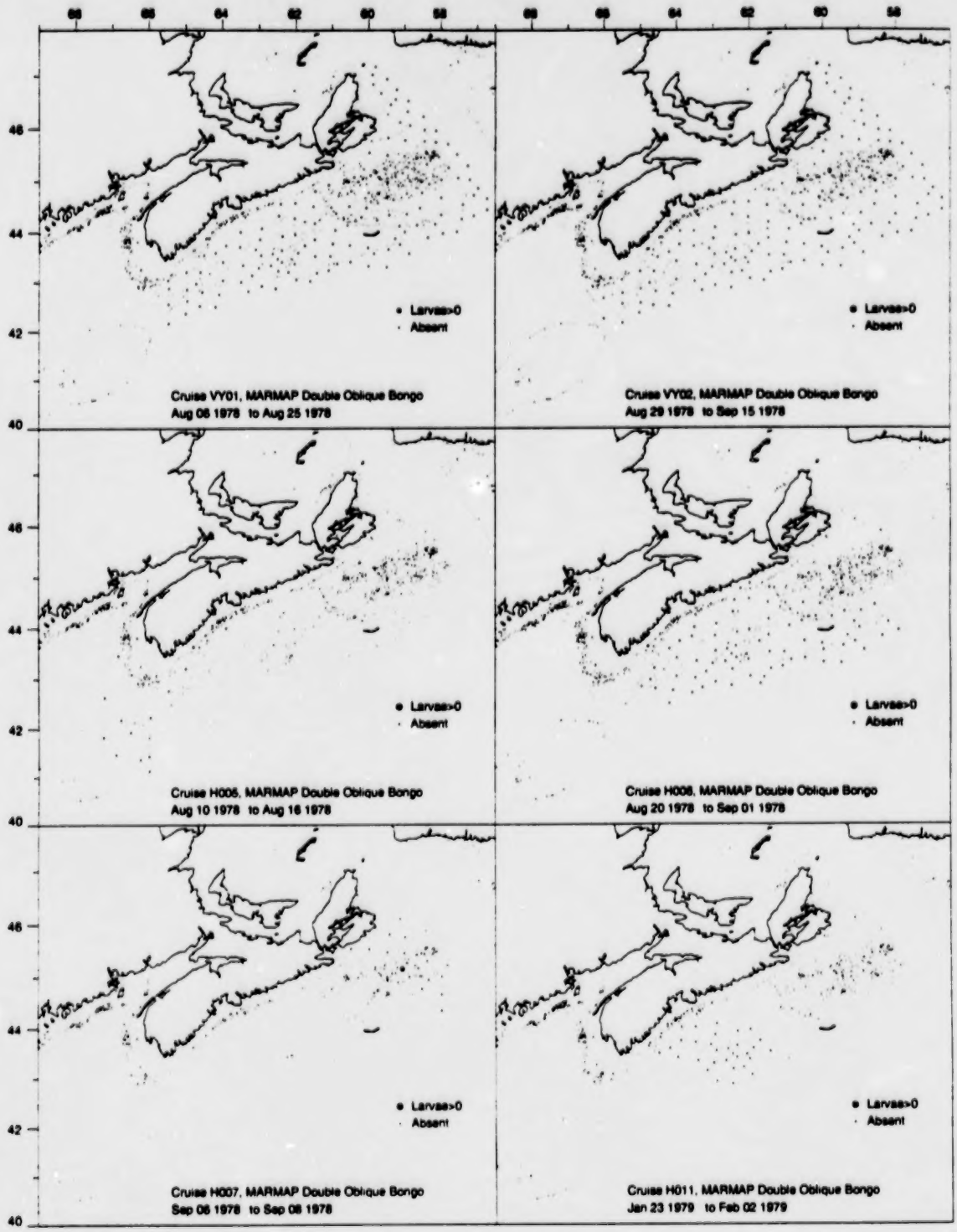
Larvae>0
Absent
Cruise VY01, MARMAP Double Oblique Bongo
Aug 06 1978 to Aug 25 1978
Cruise VY02, MARMAP Double Oblique Bongo
Aug 29 1978 to Sep 15 1978
Cruise H005, MARMAP Double Oblique Bongo
Aug 10 1978 to Aug 16 1978
Cruise H006, MARMAP Double Oblique Bongo
Aug 20 1978 to Sep 01 1978
Cruise H007, MARMAP Double Oblique Bongo
Sep 06 1978 to Sep 08 1978
Cruise H011, MARMAP Double Oblique Bongo
Jan 23 1979 to Feb 02 1979

Fig. 8.4.7. (continued).

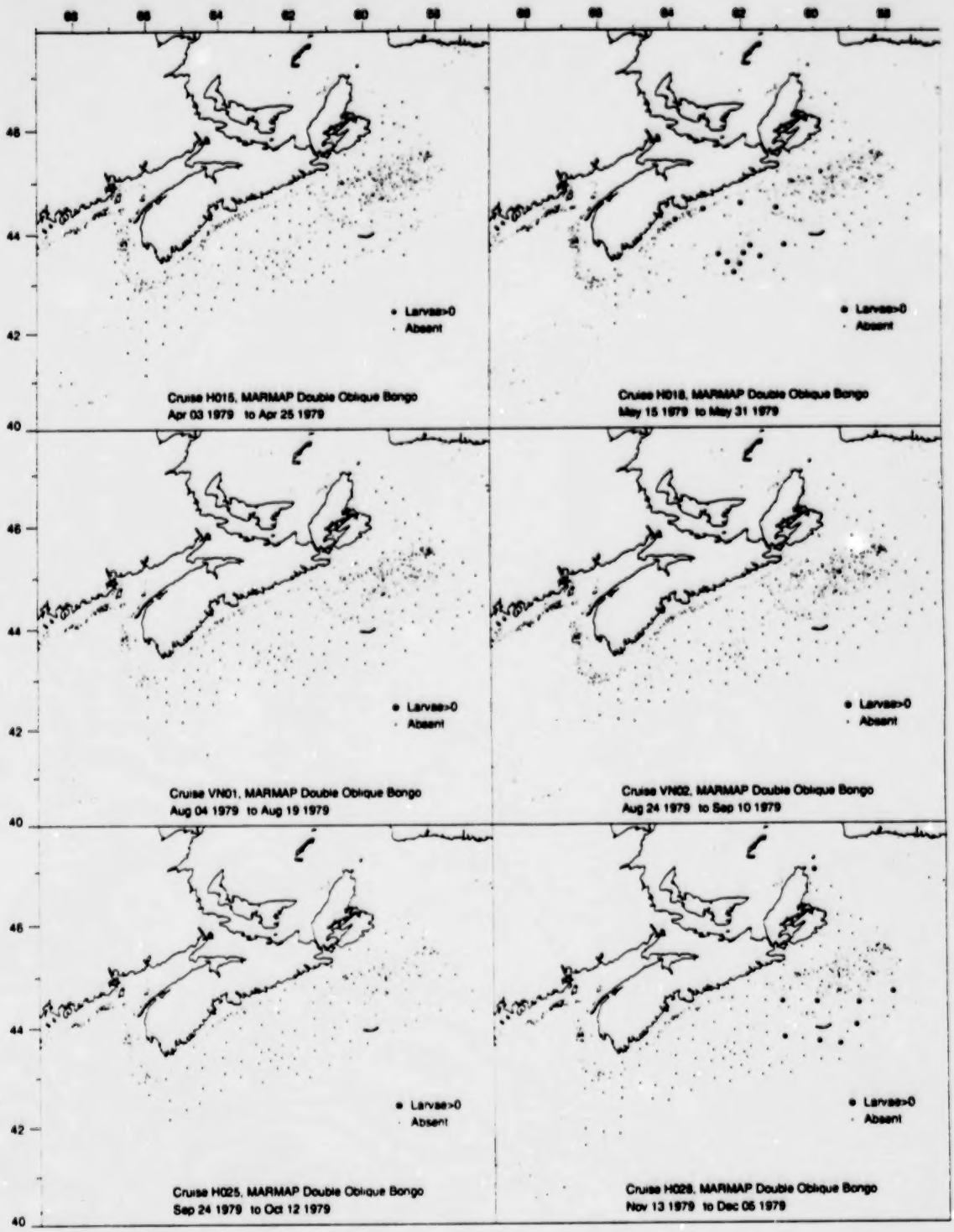
Larvae>0
Absent
Cruise H015, MARMAP Double Oblique Bongo
Apr 03 1979 to Apr 25 1979
Cruise H018, MARMAP Double Oblique Bongo
May 15 1979 to May 31 1979
Cruise VN01, MARMAP Double Oblique Bongo
Aug 04 1979 to Aug 19 1979
Cruise VN02, MARMAP Double Oblique Bongo
Aug 24 1979 to Sep 10 1979
Cruise H025, MARMAP Double Oblique Bongo
Sep 24 1979 to Oct 12 1979
Cruise H028, MARMAP Double Oblique Bongo
Nov 13 1979 to Dec 05 1979

Fig. 8.4.7. (continued).

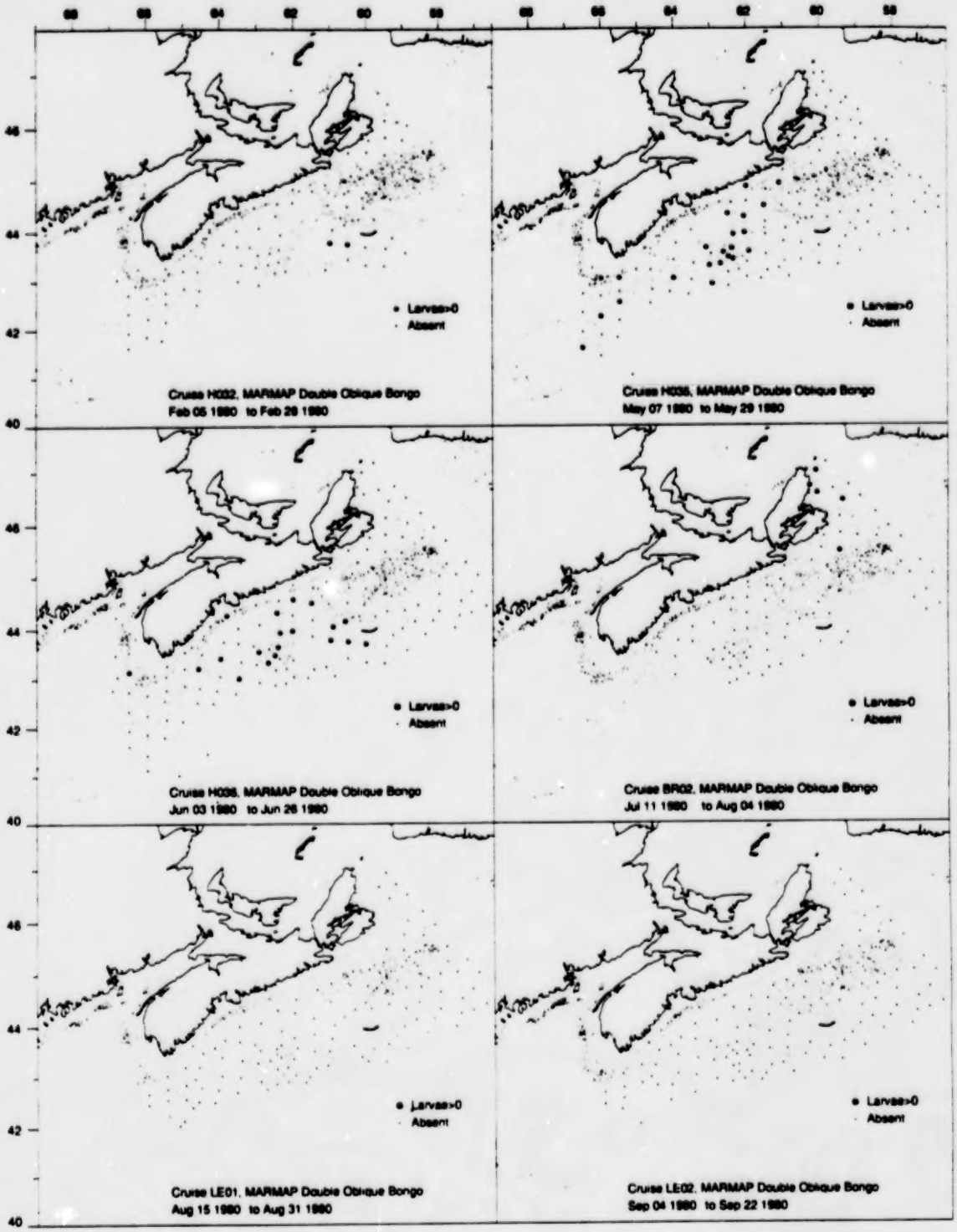
Larvae>0
Absent
Cruise H032, MARMAP Double Oblique Bongo
Feb 05 1980 to Feb 28 1980
Cruise H035, MARMAP Double Oblique Bongo
May 07 1980 to May 29 1980
Cruise H036, MARMAP Double Oblique Bongo
Jun 03 1980 to Jun 26 1980
Cruise BR02, MARMAP Double Oblique Bongo
Jul 11 1980 to Aug 04 1980
Cruise LE01, MARMAP Double Oblique Bongo
Aug 15 1980 to Aug 31 1980
Cruise LE02, MARMAP Double Oblique Bongo
Sep 04 1980 to Sep 22 1980

Fig. 8.4.7. (continued).

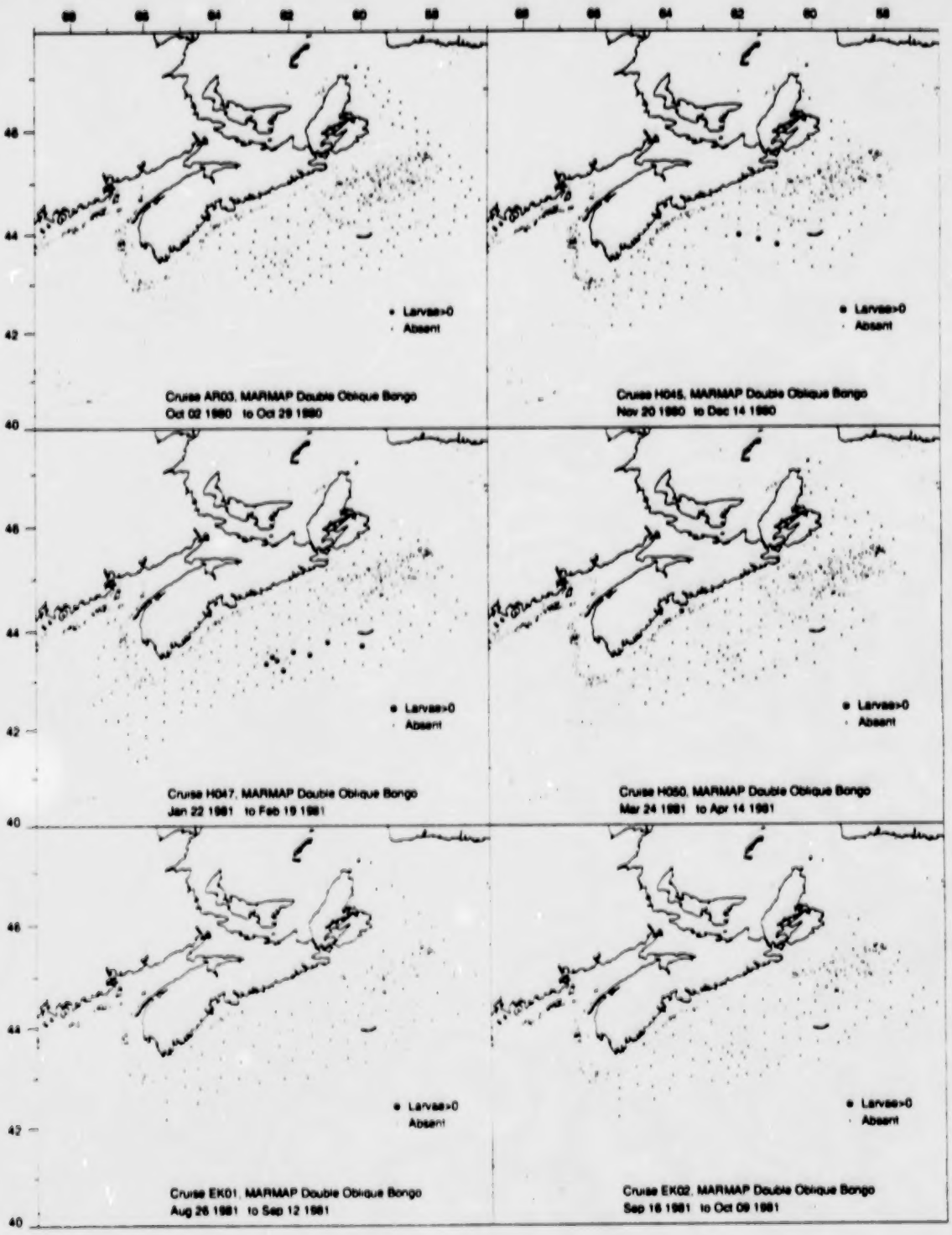

Fig. 8.4.7. (continued).

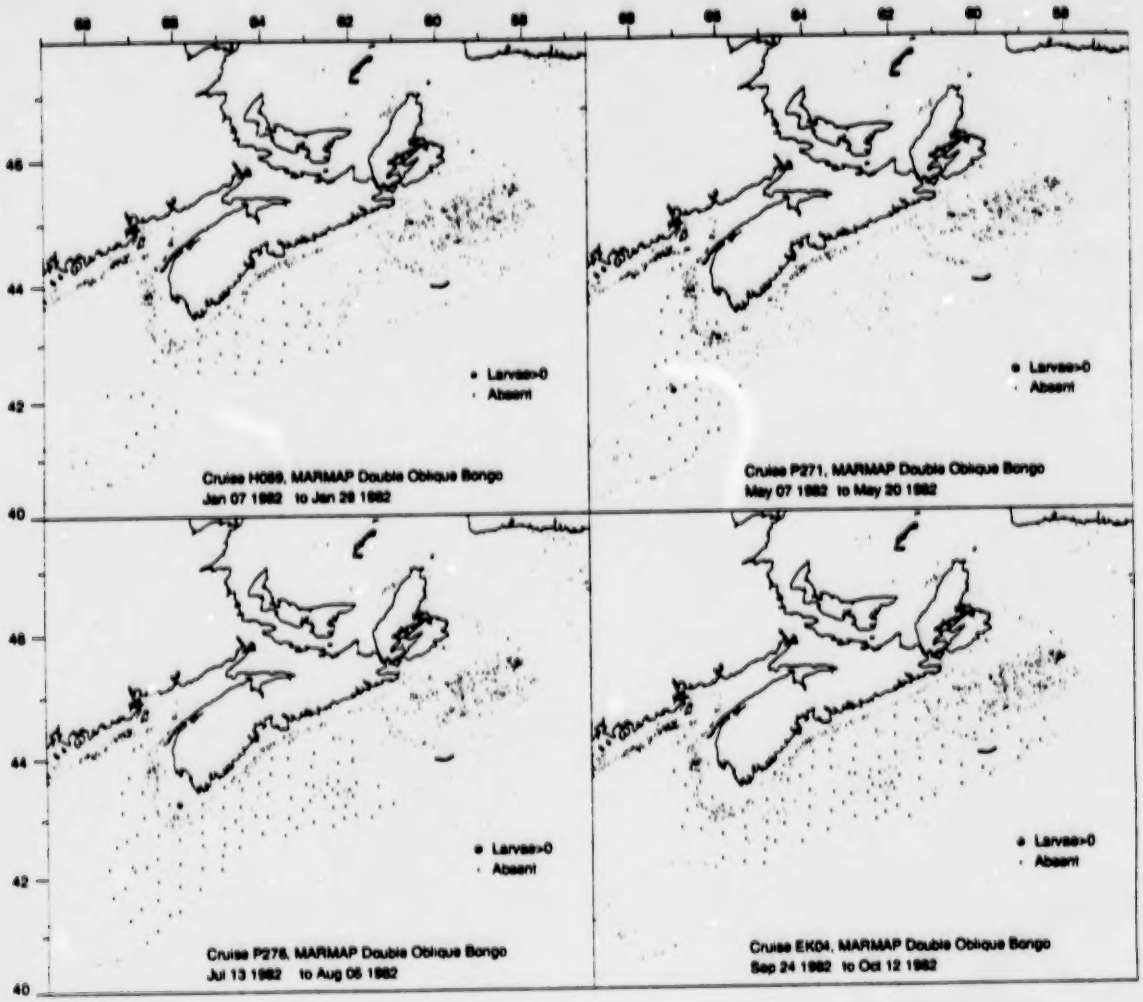
Larvae>0
Absent
Cruise H089, MARMAP Double Oblique Bongo
Jan 07 1982 to Jan 28 1982
Cruise P271, MARMAP Double Oblique Bongo
May 07 1982 to May 20 1982
Cruise P276, MARMAP Double Oblique Bongo
Jul 13 1982 to Aug 05 1982
Cruise EK04, MARMAP Double Oblique Bongo
Sep 24 1982 to Oct 12 1982

Fig. 8.4.7. (continued).